IN THIS ISSUE:—WHAT IS THE MATTER WITH MODERN HEATING PRACTICE?

THE HEATING AND VENTILATING MAGAZINE

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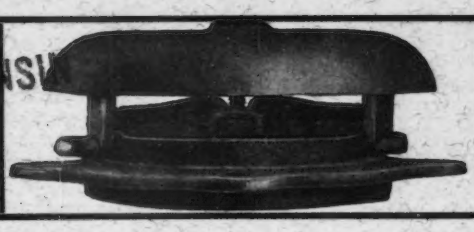

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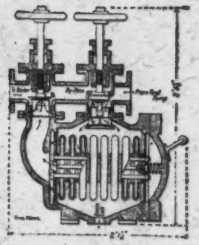

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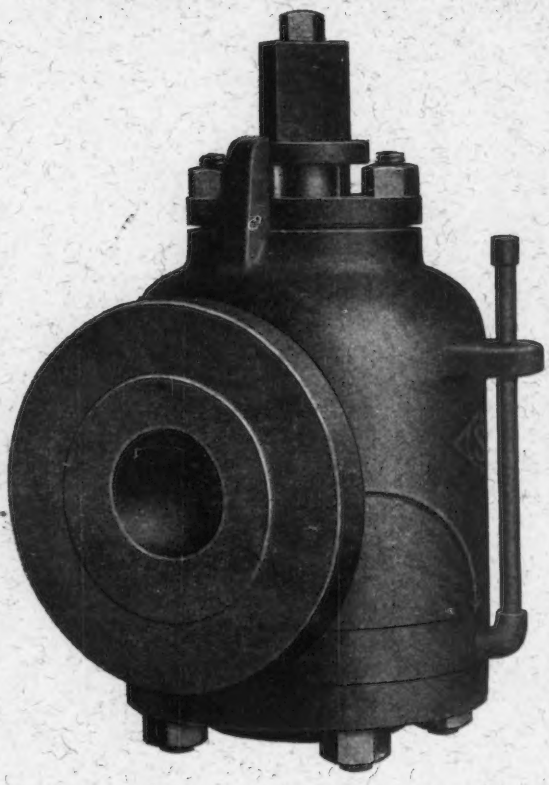

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK JANUARY, 1911

The Transmission of Air and Its Movement in Ducts

THE DEVELOPMENT OF A NEW SCHEME FOR PROPORTIONING AIR DUCTS AND OUTLETS

BY GEO. W. KNIGHT AND PERRY WEST

If a ball be started rolling upon a smooth, level plane, it will continue to roll, constantly reducing in speed, until it finally comes to rest. The kinetic energy of the ball at any point throughout its path will be exactly equal to its kinetic energy at the start, less the energy expended in friction up to this particular point. In other words, if the expression may be applied, the velocity head of the ball at any point will equal its velocity head at the start, minus the friction head up to this point.

In like manner, if a section of the air moving in a straight uniform sized duct could be suddenly isolated from the remaining air in this duct, and left to move, without the action of any exterior force, it would move in a manner similar to that of the ball described above. The velocity head at each point of its movement would be equal to the velocity head which it had at the point of isolation, minus the friction head between this point and the other point under consideration. The section of air would continue to move, constantly reducing in velocity, until it came to rest at a point where the friction head exactly equalled the original velocity head; and the sum of the friction and velocity heads would be the same at every point throughout the path of travel, and would equal the original velocity head.

In the case of the ball, if it is desired to keep the speed of travel constant, a constant exterior force, equal to the friction head, must be applied to the ball throughout its travel; and likewise with the isolated section of air. In the case of air this exterior force would be termed a static pressure or head, and would be constant for an infinitesimally short section of the air only. In the case of a length of duct, through

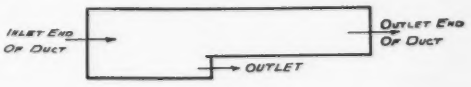


FIG. 1

which air is transmitted at a constant velocity, and discharged at atmospheric pressure, the static head at the entering end would equal the total friction head of the duct, while the static head at any other point throughout the duct would be less, but would always equal the friction head between the point in question

and the outlet end of the duct; becoming zero at the outlet end.

Therefore, the static pressure in a uniform sized duct, through which air is transmitted at a uniform velocity, builds up from the outlet end towards the inlet, and the total pressure at any point is equal to the velocity head, plus the static head. If an outlet (Fig. 1), be provided in such a duct and the duct area between this outlet and the outlet end of the duct be decreased, an amount depending upon the quantity of air taken out, the velocity within the duct will remain constant, but the velocity through the outlet will be greater than the velocity in the duct, since the velocity head at the outlet must equal the sum of the velocity and static heads within the duct.

Again, if a duct be attached to this outlet and continued (of equal size)

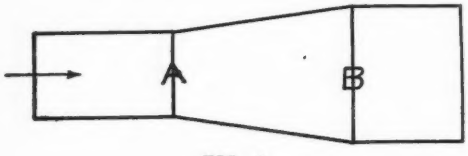


FIG. 2

for any length, the velocity through the duct will be less than it was through the outlet before the duct was added, since, in this case, the velocity head plus the friction head in the added duct must equal the same sum (of the velocity and friction heads in the main duct) as was formerly equalled by the velocity head alone, at the outlet.

Also, since the introduction of a Pitot tube into the air current of a duct produces in the tube a static pressure equivalent to the velocity head in the duct, the bringing of air in motion to rest must produce a static pressure equivalent to its velocity head.

Carrying this a little further, if, instead of having the outside end of the small tube of the Pitot instrument blanked off, a small pet cock be provided so as to vary the velocity through this tube to the outside air, we would get static pressures within the tube equal to the velocity head in the duct, minus the velocity head in the tube. Or in other words, if the velocity of air in motion be decreased, without eddies or friction, a static head is produced exactly equivalent to the difference in the velocity heads.

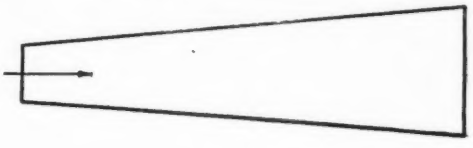


FIG. 3

In a duct, therefore, such as shown in Fig. 2, the decrease of velocity between the points (A) and (B) produces a static head equal to the difference in the velocity heads at (A) and (B), minus the friction and eddy losses between these two points.

This action has been tested in practice, and found to agree with theory; and when the slopes of the increaser are gradual, the losses from friction and eddies are found to be negligible. A duct constructed with a gradual taper, therefore, (Fig. 3), and increasing in such a way as to make the friction head at any point equal to the difference between the velocity head at this point and the velocity head at the end of the duct from which the friction head is figured, will be entirely free from static pressure due to friction.

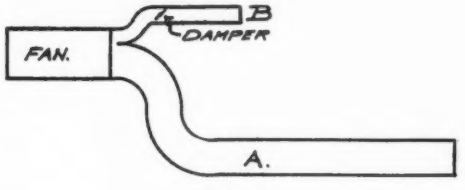


FIG. 4

This is evident from the fact that the rate of loss in velocity head is everywhere just equal to the rate of friction head being added, and the two balance one another.

With these few fundamental principles before us, we will pass to the subject of the practical movement of air in ducts. The problem is to dis-

tribute the required quantity of air at the minimum cost, consistent with conditions. One of the principal items of cost is for power to handle the air. Neglecting everything else, outside of the distribution system, about all that remains are the overhead charges on the cost of this system and the value of the space which it occupies. Regarding the space occupied there are so many conditions such as the character of building,

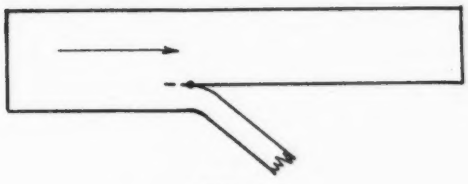


FIG. 5

disposition of ducts, etc., that same will be neglected here, except to say that usually ducts may be run where the value of the space for other purposes is of no consequence. The power required for forcing the air through the duct system is almost exactly proportioned to the total head in the ducts and this head is generally equal to the total head in the longest duct.

Inasmuch as this head or pressure must be maintained at the fan outlet, all other ducts starting from this same point should have the same total head (velocity plus static) at their starting point. The logic of this may be seen by reference to Fig. 4, showing two ducts (A) and (B), connected to the same fan outlet. Assuming that (A) is the longer of the two ducts, and that it consequently has a higher friction head, duct (B) should be designed for a velocity such that the sum of its velocity and friction heads will equal the sum of the velocity and friction heads in duct (A). If duct (B) be made larger on the assumption that it should transmit air at the same velocity as duct (A) does, it would not do so without the use of a damper, since the total head delivered by the fan is the same for both ducts, and if the total head in duct (B) is less than in duct (A), then the velocity in (B) will automatically increase up to a point where these total heads are equal. The introduction of a damper, therefore, for creating a friction head instead of decreasing the duct size, evidently results in a waste of duct material and space.

Again, if a branch duct is taken off a main duct (such as shown in Fig. 5), the design should be such that the total head for each duct will be the same at the junction point, and for the same reasons as cited above.

By this procedure the main distribution ducts may be designed on the most economical basis, provided the total head at the fan is properly selected to start with, so as to give the proper velocity through the duct having the highest total head at the fan.

This critical velocity may be determined as follows: Find the horsepower required to handle the total quantity of air at the total head selected and determine the cost of this per year. Compare this with the overhead charges on the distribution system and adjust the two to a point where their sum is a minimum.

Taking a recent building as an example, the galvanized iron ducts were designed for maximum velocity of 1,500 ft. per minute. This is equivalent to 0.08 oz. pressure per square inch head at the fan.

The total quantity of air handled is 36,000 cu. ft. per minute and the cost of the main duct system, exclusive of short connections to outlets, is $1,500. The yearly cost of power for forcing the air through these ducts at $0.05 per k. w. hour, for six hours per day, twenty days per month and eight months per year, figuring the total efficiency of the fan unit at 50 per cent., is $75.00. The overhead charges on the duct system at 10 per cent. is $150.00.

Assuming that the cost of ducts would be inversely proportional to the velocity, and that the cost of power would be directly proportional to the square of the velocity, it

will be seen that the above system operates at about a minimum cost for this particular building.

It may be noted here that no static pressure in figuring this power is allowed for, as the duct system in question is designed so as to eliminate static pressures, as will be explained later. It is not necessary to figure out this critical velocity for each and every building for which a duct system is to be designed, as the same velocity may be safely used for each class of building with certain modifications covering different sizes and peculiarities of layouts.

In figuring the friction head in ducts the following formula may be used:

$H=KLV^2R$, when (H) = the friction head in ounces per square inch, (K) equals a constant, depending upon the condition of the duct surface; (L) = the length of duct in feet; (V) = the velocity of air in thousands of feet per minute, and (R) = the ratio between the perimeter of the duct in inches and its cross sectional area in square inches. For smooth galvanized iron ducts (K) may be taken as 0.0028.

Thus for a galvanized iron duct 12 in. x 12 in. 50 ft. long, transmitting air at a velocity of 2,000 ft. per minute the friction head (H) = 0.0028 x 50 x $(2)^2$ x 0.333 = 0.1866 oz. per square inch. The friction around turns and elbows must be added to that for the straight length and may be figured from the above formula by allowing for (L) a value equal to a certain number of diameters for round pipes and to a certain number of widths for rectangular pipes. The following table gives the equivalent straight pipe for 90° ells, in diameters, for different radii of ells.

A	B
0.5	29.0
1.0	10.3
1.5	6.0
2.0	4.4
2.5	4.6
3.0	4.8

A=Ratio of inside radius of elbow to diameter of pipe.

B = Equivalent number of diameters of straight pipe.

After the main ducts of a system are disposed of, the question arises as to how the air can best be delivered from these ducts through the various outlets. The prime considerations in bringing fresh air into any space are thorough distribution and proper velocity. It is evidently impossible to properly distribute air throughout all portions of a room unless a uniform velocity is secured over the entire area of the inlet openings.

The velocity at which air should enter any space depends entirely upon the location of the registers (height from floors, etc.), dimensions of space and the use for which this space is intended, but at the same time air should never enter any space so as to create objectionable draughts. The maximum velocities allowable so as to entirely eliminate drafts have been pretty well determined.

An opening having an uneven velocity of discharge is objectionable for the reason that, if the highest velocity is below the allowable maximum, the total discharge is below what an opening of this size should give, and the opening is unnecessarily large; if the highest velocity is increased so as to give the opening its proper discharge, this velocity is above the allowable. The design of the main duct system, as well as that of the connections between these main ducts and the various delivery openings, has much to do with this matter of the proper distribution of air through the openings.

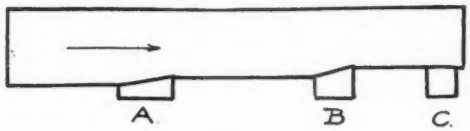


FIG. 6

Taken in all of its phases, the question of properly transmitting and distributing the air from the main ducts through the openings, is perhaps one of the most important

connected with the design of duct systems.

Take a duct, for instance, which is designed for a uniform velocity of air throughout its length (with all openings open) and having the three openings (A), (B) and (C) (Fig. 6).

The velocity head in the main duct will have little or no influence upon the velocity of discharge through these openings. Whatever the discharge velocity, it will be almost wholly due to static head, and will vary for the three openings, being greatest at (A) and practically zero at (C).

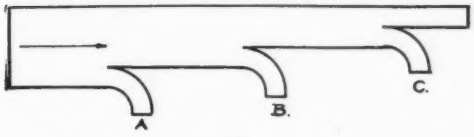


FIG. 7

Take another duct designed as before, for a uniform velocity of air throughout its length (with all outlets open) and having three outlets (A), (B) and (C), but with the outlets arranged as in Fig. 7.

Here the velocities through (A), (B) and (C) will depend upon the velocity in the main duct as well as upon static pressures, the greatest velocity will be through (A), as before, but the velocity at (C) will not be zero and the difference between outlet velocities will not be so marked. This variation in velocities will depend upon the ratio between velocity head and friction heads in the main duct. If the distance between openings is great and the main duct small, the friction will be great, and consequently the static head at (A) high; and the higher this static head the greater its influence towards unequal outlet velocities.

If with either of the two above ducts a section of the outlet end of the main duct be blanked off, and the remaining outlets adjusted so as to maintain an even velocity throughout the main duct, an additional and constant static pressure will be created along the entire duct, which will act upon each outlet similarly to the action of the frictional static head just mentioned, except that one is constant, and the other varies for the various outlets.

It is readily seen that it is a very difficult matter to properly design outlets from this type of duct, and to tell beforehand what the velocities of discharge will be. It is true in the case of Fig. 7, that the area of outlets may be proportioned for the same velocity through the outlet as is maintained in the duct, but the velocities through (A) and (B) will be greater than required and must be cut down by a damper, causing higher velocities than would otherwise be gotten through the proper sized opening.

Again, in a main duct designed for uniform velocity, if a short connection be taken off to a large opening, as shown in Fig. 8, the velocity head tends to create a flow of air out through the opening as shown by the curved arrows, while the static head tends to create a flow as indicated by the straight arrows. The result is that there is no way of estimating what the distribution will be through such an opening for the varying combinations of velocity and static heads met with in practice.

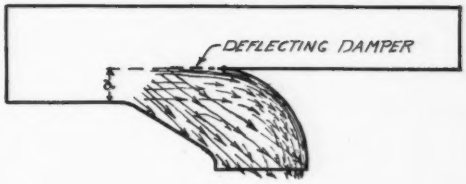


FIG. 8

The determination of the dimension (a) (Fig. 8) is also impractical and results in deflectors set at all kinds of sharp angles. The authors of this paper, after coming to a full realization of these many difficulties surrounding the proper distribution of air from ducts designed on the uniform velocity principle, have developed a system for designing ducts without static heads.

DUCT SYSTEMS WITHOUT STATIC HEADS

The principle discussed in connec-

tion with Fig. 3 was made use of; the idea being to begin at the first outlet in each duct and decrease the velocity continually, to the end of the duct, in such a way as to allow the friction head at all points to be offset by the static head due to loss in velocity head. This gives a duct such as shown in Fig. 9.

Here the dimensions (a) and (b) may be more readily and correctly determined, by simply allowing for a velocity through the area of opening at these points equal to the corresponding velocities in the duct; which greatly simplifies the design. Long ducts designed on this principle are smaller at the beginning or large end and larger at the terminating or small end than constant velocity ducts designed for the same service and having the same total head would be.

For this reason some very objectionably large main ducts are reduced near the fan, or starting point, and the smaller ones which create friction fastest out near the end are enlarged. The system as a whole, being thus equalized and being more uniform, is easier to build and accommodate. The elimination of static heads, while it greatly facilitates in the correct designing of the outlet, does not otherwise assist in the production of a uniform velocity through the same.

The velocity through opening (A) (Fig. 9), may be expected to vary as shown by the arrow diagram. This condition may be materially improved by the introduction of diffusing plates such as shown at outlet (B), where the discharge velocities will be about as shown by its arrow diagrams.

If, in such a duct, the outlets be arranged as at (C), with an adjustable extension deflector and these deflectors be set, as shown, so as to lessen the velocity effect, a static pressure will be created in the duct, and act as indicated by arrows. By the proper adjustment of this deflector, a fair distribution should result. The static head necessary will

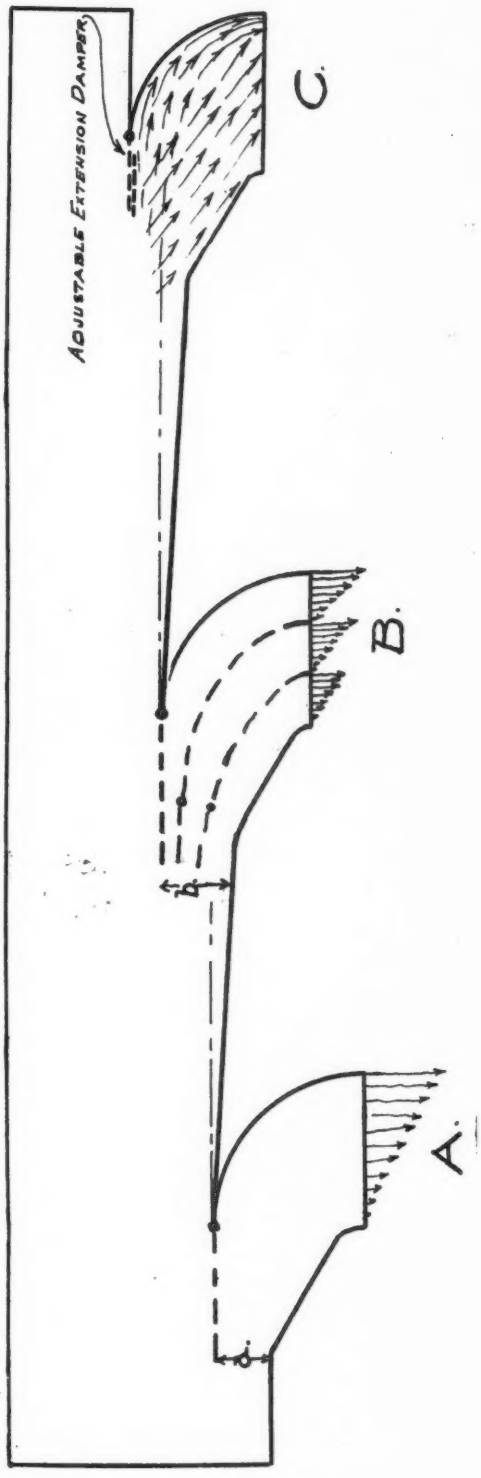


FIG. 9

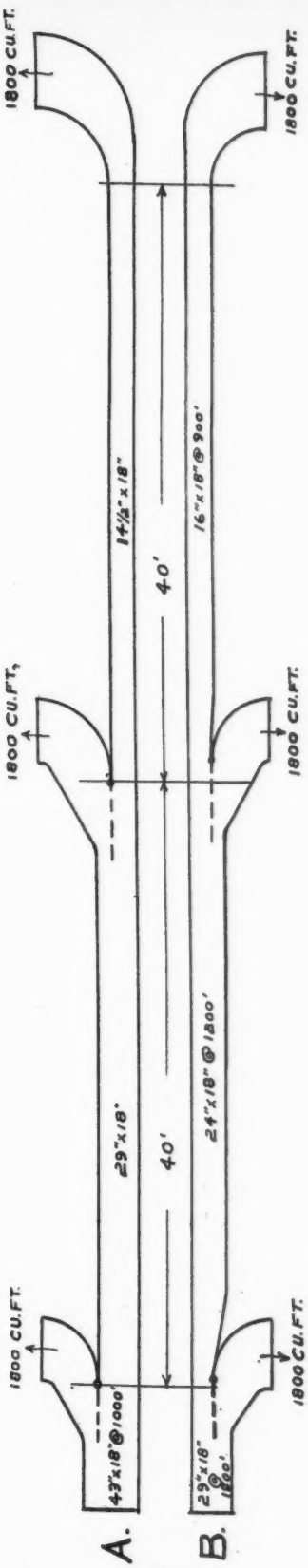


FIG. 10

be additional to the velocity head, and will require additional work to be done by the fan. This design is wasteful of power, therefore, since the same velocity head must be maintained, and, in addition, a static head.

Fig. 10 shows a comparison of two ducts designed for the same purpose and to operate under the same total head. Duct (A) is designed on the constant velocity principle, and duct (B) is designed on the reducing velocity principle, to eliminate static pressure.

It will be seen that there is less material in duct (B) than in duct (A), notwithstanding the increasing sizes toward the end.

The question now naturally presents itself, how to maintain a high velocity in the main ducts, and at

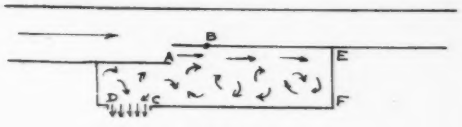


FIG. 11

the same time secure a low even velocity at the registers. Obviously, it is first necessary to do away with a portion of the velocity head, leaving just enough to give the air the proper velocity at the register, but while accomplishing this, we should not lose sight of the fact that it is imperative that the velocity at the register be uniform over the entire area.

In order to lose a portion of the velocity head, it is necessary only to place some obstruction, such as a damper, in the path of the air, but to secure an absolutely uniform velocity over the entire register area, is a more serious problem. In order to accomplish this double purpose, viz., a reduction of velocity head, with uniform velocity at register, a duct was made with a large box attached to it, the register opening being behind the point where the air enters the box at a high velocity. (Fig. 11.)

The object of the large box was to allow the air to swirl around as indicated by the arrows, losing a portion of its velocity head and then find its way out at the register opening. The end (EF) was so arranged that it could be moved up toward (B), the assumption being that

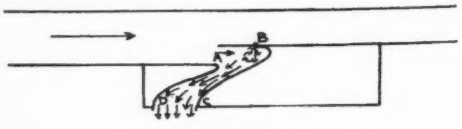


FIG. 12

this end would be moved backward and forward (varying the friction head), until the proper velocity at the register opening was secured. Under low velocities, the operation was perfect, but with a velocity of 1,000 ft. per minute in the main duct, the experiment was only partially successful, in that the velocities at the register opening were extremely variable.

A great many tests at different velocities were made with this form of duct, but the results for like conditions, with respect to a uniform velocity at the register opening, varied to such a degree that it was evident that the air, after leaving the opening (AB), should be conducted through a passage of particular shape to the opening (DC), in order to secure a uniform velocity at (DC). In order to arrive at the proper shaped passage, the points (BC) and (AD) were connected with thin sheet iron, and the shape of these two sheets of iron was continually changed, until a uniform velocity was secured.

The form shown in Fig. 12 was one that finally evolved, and which gave perfect results, and after having conducted a great many tests on this form of connection, during which tests the travel of the air in the connection was carefully noted, the dimensions of the connection were computed, and put on a scientific basis, as shown by Fig. 12.

Economy in the Ventilation of a Hospital Building

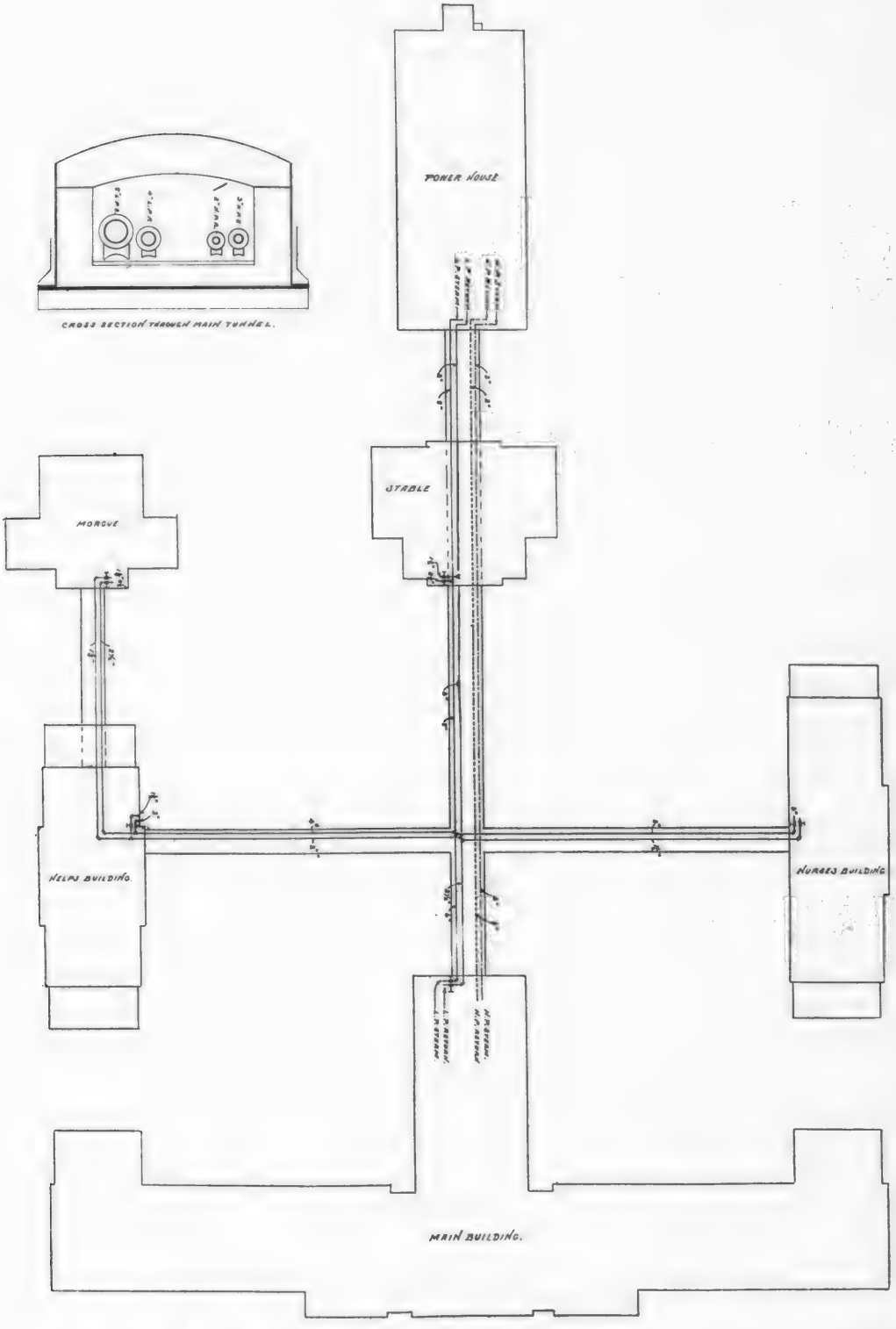
FEATURES OF THE MECHANICAL EQUIPMENT OF THE CONEY ISLAND HOSPITAL, BROOKLYN, N. Y.

The accompanying plans illustrate an interesting solution of a heating and ventilating problem in which it was necessary to cut the cloth to fit the pocketbook, or, in other words, to bring the cost of installation within the limits of the appropriation, at the same time securing the desired results.

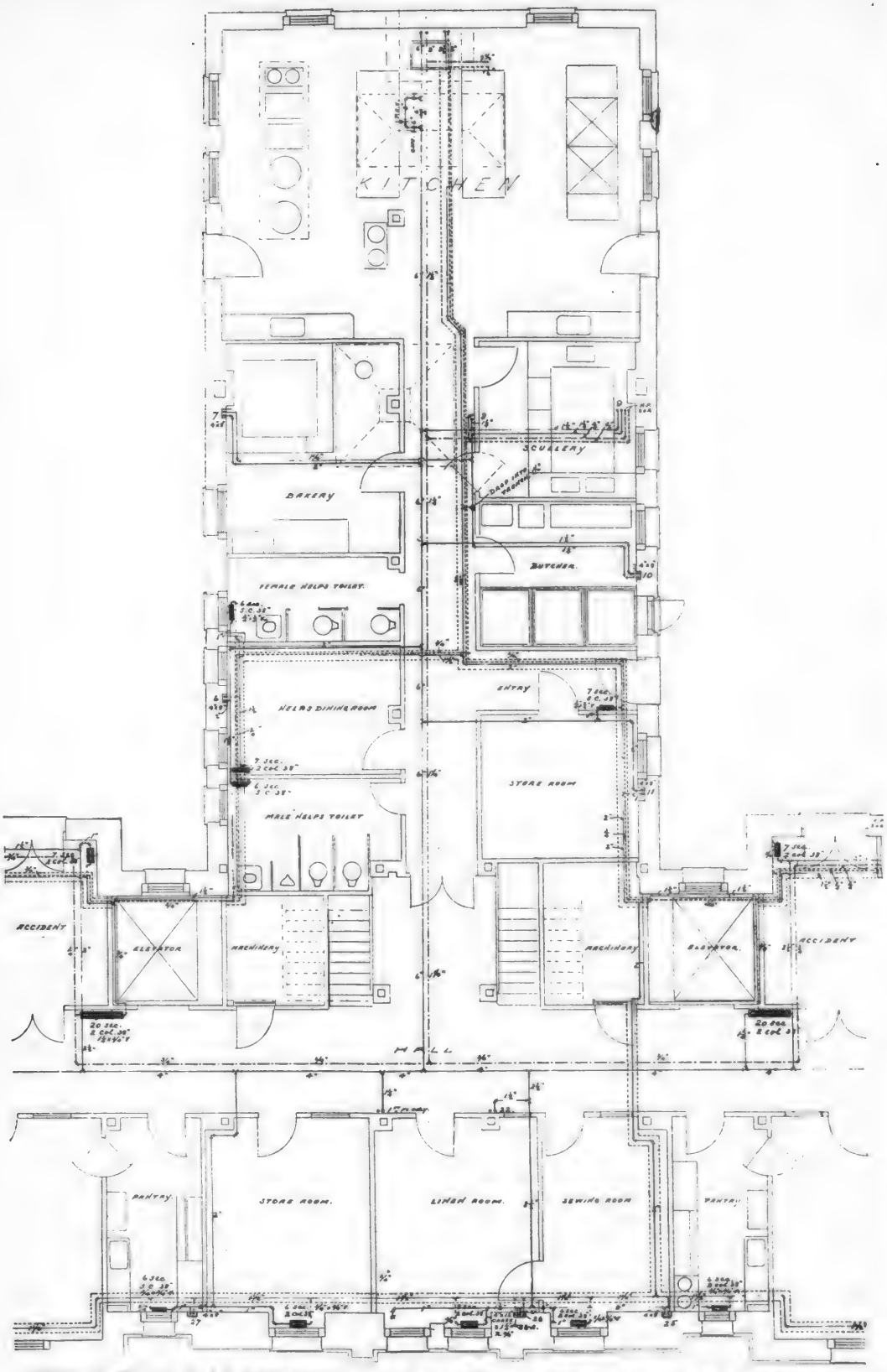
The original scheme for heating and ventilating the Coney Island Hospital provided for mechanical ventilation, with fans and ducts. The accompanying plans show the alternative scheme decided upon to reduce the first cost.

The main hospital building it will be noticed is, for the most part, heated and ventilated by means of indirect radiation, the air being extracted near the floors of the rooms and thence through ducts and flues to the roof by means of aspirating coils.

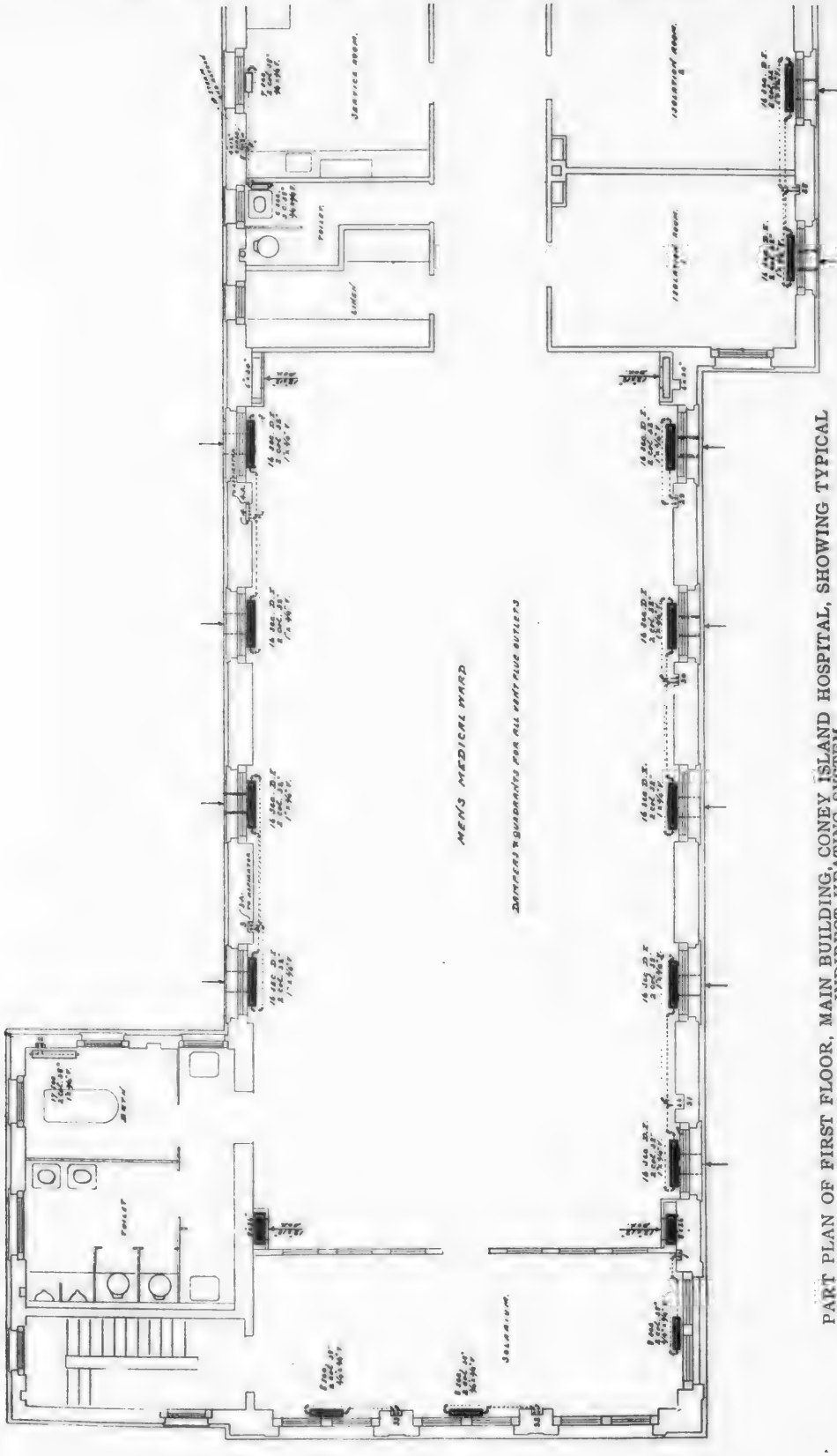
There are six buildings in the group including the main hospital building, nurses' building, helps' building, stable, morgue and the power and laundry building. Concrete pipe ducts connect the various buildings with the power house as shown on the block plan. These ducts are composed entirely of concrete, with concrete manholes. In the main hospital building the return pipes are carried along the ground floor in concrete pipe trenches 12 in. wide and 12 in. deep. These trenches completely encircle the building and are run close to the exterior



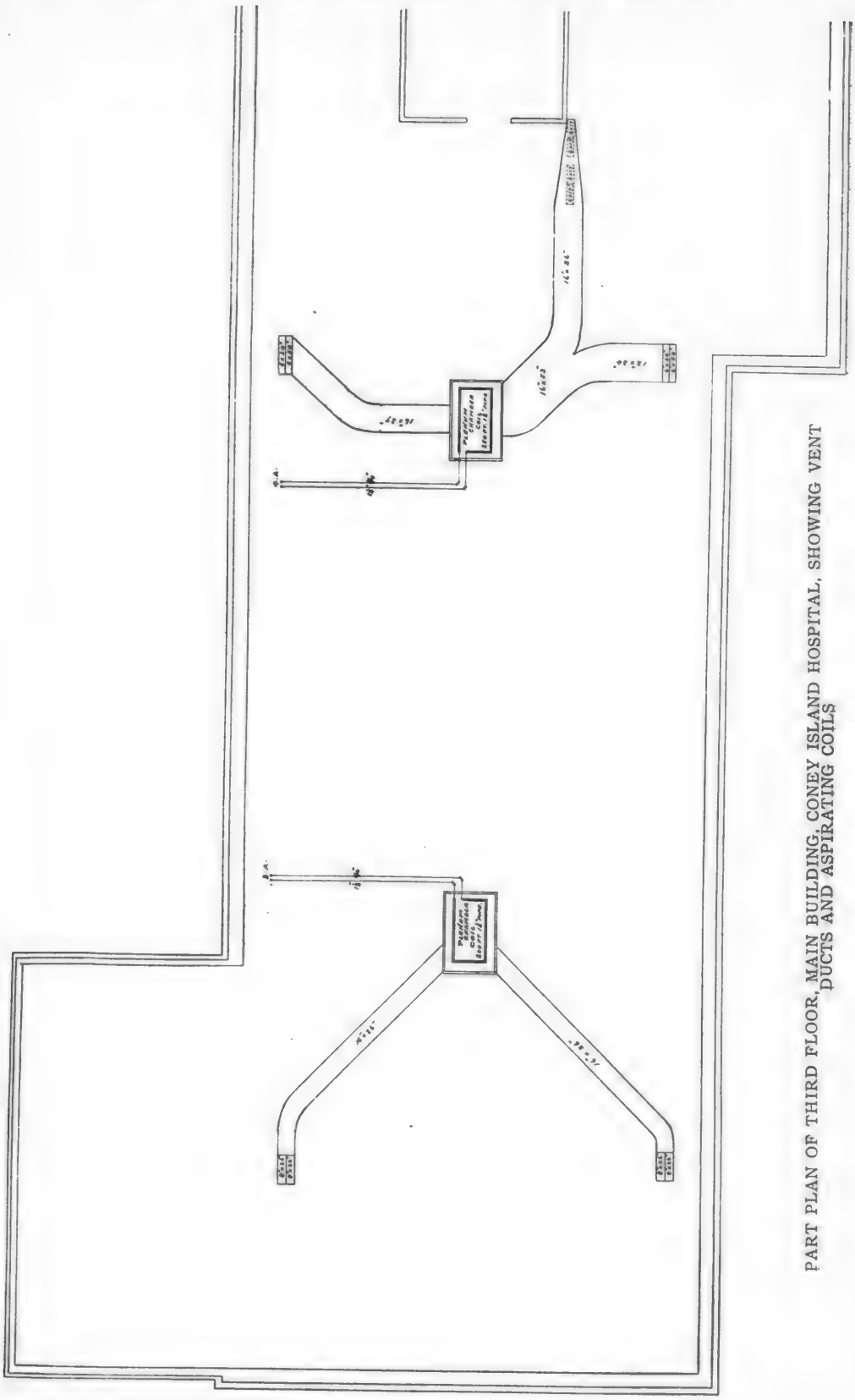
BLOCK PLAN OF CONEY ISLAND HOSPITAL, SHOWING STEAM PIPE LINES AND SECTION OF MAIN TUNNEL



GROUND FLOOR PLAN, MAIN BUILDING, CONEY ISLAND HOSPITAL, SHOWING TRENCHES FOR RETURN MAINS



PART PLAN OF FIRST FLOOR, MAIN BUILDING, CONEY ISLAND HOSPITAL, SHOWING TYPICAL INDIRECT HEATING SYSTEM

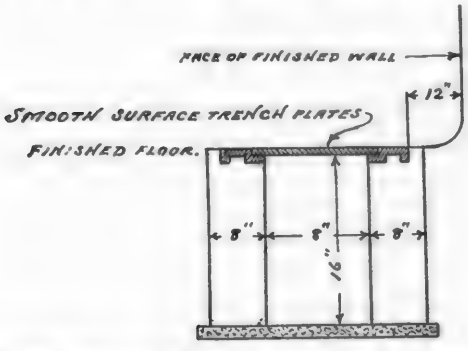


PART PLAN OF THIRD FLOOR, MAIN BUILDING, CONEY ISLAND HOSPITAL, SHOWING VENT DUCTS AND ASPIRATING COILS

walls. They are provided with iron trench covers. Most of the flooring on the ground floor is of cement.

The power plant is designed not only to heat and ventilate the buildings, but also has high pressure connections to the kitchen fixtures, serving tables and sterilizers in the main building. The heating is accomplished by a two-pipe vacuum steam system.

For these purposes two horizontal tubular boilers are used, each 72 in. in diameter and 16 ft. long. High pressure lines are run to two 7½ x 5 x 8 in. duplex steam pumps and



CROSS-SECTION OF TRENCHES IN ROOMS AND PASSAGES OF MAIN BUILDING

two 8 x 12 x 12 in vacuum pumps. Other auxiliaries in the power house include two hot-water generators, each capable of heating 1,000 gals. of water per hour, raising the temperature from 40° to 120° F. by means of exhaust steam at 1 lb. pressure and one 500 H. P. open feed water heater.

The main steam pipe starts at the duct entrance of pit in the power house, after first receiving the exhaust supply through a gate valve and reduced pressure steam through a reducing valve. The heating and high pressure mains travel through the duct to the main building, with outlets for the heating mains to the other buildings. The pipes enter the main building through a vertical duct rising to the ceiling whence the heating main continues around the ceiling of the main building. The return mains and branches in the main building are carried, as stated, in concrete trenches, and thence through the concrete tunnel, terminating at the vacuum pumps in the power house.

Special temperatures are required in many of the rooms, varying from 90° in the operating room to 65° in the toilets.

The vitiated air is removed from the rooms through a system of vertical and horizontal iron vent ducts, the air being drawn from the rooms to plenum chambers in the attic. Here the ventilation is assisted by aspirating coils, as shown. The steam supplies for these coils are taken separately from the high-pressure pipes in the basement. Each coil contains 100 sq. ft. of heating surface and is made of 1¼ in. pipe, supported on brackets. The horizontal vents are collected separately into these plenum boxes, one of which is located over each of the north and south wings and one over the center section of the building. The tops of the plenum or ventilating chambers have each a 36 x 48 in. automatic ventilator.

The terminating openings of each vent in the rooms which they are drawing from is near the floor in each case and have cast-iron white enamel vent registers.

The power plant and heating and ventilating work was designed and installed by Blake & Williams, New York. The architects for the hospital are Helmle & Huberty, Brooklyn, N. Y.

The ever-pressing question of proper ventilation in the rooms of the Chicago public schools, one that has given rise to discussions and experiments in "open-air" rooms, increased humidity and the employment of numerous other devices, has taken on a new angle in the form of an introduction of ozone as a possible stimulant to produce good air.

The possible merits of ozone have been discussed by the members of the school management committee of the board of education. It has decided to permit the installation of ozonizers in several schoolrooms for the purpose of experiment.

What Is the Matter with Modern Heating Practice?

THE ANSWER OF AN EXPERT TO THE AGITATION AGAINST PRESENT METHODS

By Konrad Meier

There is a widespread feeling that the modern ways of heating, though more efficient, are not as healthy as the open fire-place, the Dutch tile oven, or even the ordinary stove. Evidently, there must be some basis for this contention. We need only remember that the close, lifeless air and stuffiness too often met in buildings heated by boiler or furnace cannot always be traced to crowded occupation. Nor can it be the failure to use the windows, inasmuch as the desire to open them is rather induced, sometimes almost compelled, by these conditions. Another significant fact is that the demand for ventilation has only arisen since hot-air registers and radiators have become general. No further evidence is necessary for the general conclusion that present day methods of heating in some way spoil the air, but it is worth while to look further into cause and effect in order to find the right means of prevention.

THE VITIATION OF AIR BY HEATING

At first thought there seems to be no reason why a steam heating apparatus, or a hot-air furnace in good condition, should alter the quality of the room air, aside from an unavoidable drying effect, not necessarily objectionable in itself. Nevertheless, on closer investigation some distinct causes of vitiation, not recordable by the ordinary methods of air testing, have been shown to exist, and found to create unwholesome conditions. We are indebted especially to two noted German hygienists, von Esmarch and Fluegge, for their investigations on this elusive subject. They have established that the stuffiness of air in heated rooms is caused by the decomposition of dust in contact with radiating surfaces at temperatures of 160° F. and higher.

This process is not one of full combustion, generating carbonic acid, but a sort of dry distillation or singeing of the organic matter, which produces small quantities of the highly injurious ammonia, also traces of carbon monoxide and other gases. The presence of the former gas is explained by the quantities of animal excreta, one of the principal ingredients of ordinary street-to-house dust. It shows the little appreciated fact that dust, while comparatively harmless on furniture, will become objectionable when allowed to settle and decompose on radiators.

The gases thus generated are most noticeable after a period of interrupted heating. Under continuous service the quantities are generally too small for detection. But, in addition to this variable pollution, a constant irritation of the mucous membrane of nose and throat is kept up through the simple drying of the dust on heating surfaces, which lightens it and causes it to be picked up freely by the warm air currents. Even the dust on adjacent objects, also in ducts and air chambers, is dried and joins the procession of irritant, disease-bearing particles induced by the common forms of modern heating.

The meaning of this is plain when we remember, that the dry heat is not sufficient to kill the bacteria carried by the dust, and that we inhale them in much greater numbers owing to the currents of air created by heaters, more especially those with unsanitary surfaces. It is also the presence of fine dried dust which is often responsible for complaints from dryness. The real cause is not dryness of air, but dried dust. Pure dry air has never been shown to be harmful. It has also been established that whatever little ozone may enter a room with the outer air is quickly used up in contact with

organic dust, especially when heated. A small percentage of oxygen is absorbed in the same manner, but the extent and exact bearing of this fact has not yet been determined. These last points alone would account for the lifeless quality of the air as it generally issues from a register.

When these factors are considered, it will be admitted that an open grate, carrying its own vitiation up the flue, or a tile oven with clean, moderately warm surfaces, or even an iron stove kept polished, could not vitiate the room air to the same extent as will a radiator with inaccessible dusty surfaces, or a register blowing hot air from a musty source beyond inspection.

All this is not meant to advocate a return to the old-fashioned ways of heating, but only to show that the newer methods are actually at fault, and should be improved along lines suggested by the recent findings of hygienists. The result eventually will be a merging of the good features of past and present methods.

SANITARY HEATING

When planning apparatus, the first point in hygiene to be borne in mind should be to reduce contamination through dust by using the cleanest possible radiation. This means that heating surfaces should be in plain view, and accessible all around by hand, so that they will be kept clean, not by special effort, but as a matter of course in the ordinary routine of a household. Dust on concealed radiation, even if made accessible, is not seen, and, therefore, is invariably forgotten and neglected.

These facts should be sufficient, quite aside from engineering and economic reasons, to condemn all radiator screens designed for purposes of meaningless decoration. They are not the true solution of the problem and really turn direct radiation into a hot-air system without air supply. Screening is a sham, and should be vigorously opposed, not mildly tolerated. We should rather encourage neat, substantial appearance, inconspicuous finish and simplicity in arrangement of radiation. Unsightly bulk can often be reduced by judicious disposition and selection of the most advantageous style, or by deliberate reduction of the heat requirement, such as using double glass.

When direct radiation is indicated, it is possible, even in highly ornamental and formal rooms, to satisfy the artistic sense of architects without resorting to concealment. It is mainly a matter of judgment as to style and neatness in disposition, also of having the courage of one's conviction in arguing with the client. Of course, the public must yet be educated on the sanitary points, and the engineer on the ways and means to meet the situation. The present disinclination to expose radiators is mainly due to the shabby, clumsy and tasteless treatment that now prevails.

Radiating surfaces placed overhead or tight against walls are also objectionable. They are never dusted, except by an occasional air current, and then with a decided effect on the air. Fussy, round-about pipe connections behind radiators, creating dirt corners never cleaned out, are too often seen even in the better class of buildings. They always contribute to stuffiness, as do many styles of heating surface which are designed too much with a view to saving space and give too little chance for keeping them clean.

As will be pointed out later, indirect heat should be used only with certain restrictions. The casings enclosing the stacks should never be soldered up, or provided with a hand hole only. At least one full side should be hinged or made removable to invite occasional inspection and cleaning. Air filters should be used in cities to keep out the dust as much as possible. In general, dust pockets and dirt corners must be avoided. They are objectionable anywhere, as a latent menace to health, but become at once an active agent for mischief in connection with heat, which brings out the lurking germs and distributes them where they are most likely to do harm.

TEMPERATURES OF HEATING SURFACES SHOULD BE LOWERED

The second point of importance is the lowering of the temperature of heating surfaces, both with a view to preventing dry distillation, and for reducing the intensity of air currents. Hot-water heating gives the simplest and most effective means to this end. With the piping calculated and balanced accurately to secure even circulation at any flow temperature, it gives practically a full range of general control and makes it possible to carry heat strictly to suit the weather.

This means that for the greater portion of the heating season the temperature of heating surfaces need not reach the point at which decomposition is beginning to be felt. In hospitals, schools, and in other cases the surfaces might be increased within reasonable cost to keep the highest flow temperatures down to 160° F. or 170° F., so that a slight formation of gas could only occur under extreme conditions.

With hot-water heat applied by clean, well distributed radiation it is, therefore, quite feasible to eliminate practically all vitiation of room air through dust.

This is the reason for the popular feeling that this form of heat does not dry the air as much as steam. With the latter it becomes all the more important to insist on the cleanest form of surfaces, and to reduce the working pressure or temperature as much as possible. At best, steam heat will always be less desirable from the hygienic point of view. Hot air furnaces, to be tolerable at all, should be installed of very ample sizes, giving the desired heating effect without excessively hot surfaces.

When heating by warm air, whether furnace or indirect stacks, the registers should always be in vertical position, never horizontal. Floor registers, especially, are dirt catchers in the most aggravating form, throwing up the dried dust and microbes straight into one's nose.

OVERHEATING

According to Fluegge, the proper attention to room temperature is hardly second in importance to the benefits of ventilation as generally accepted. He has demonstrated, that overheating is just as injurious, if not more so, than the effect of ordinary foulness of air due to lack of renewal. He explains this through heat congestion, caused by decreased emission from the human body, with a consequent disturbance of certain functions. It may be held, at first thought, that summer heat would be equally, if not more injurious, but the conditions are distinctly different. Lighter clothing and freer air circulation usually allow of much greater heat emission by evaporation, except in the hottest and sultriest weather which is known to be a tax on vitality even for short periods. In crowded, overheated, though ventilated rooms, with the occupants close together, keeping each other warm by their own radiation, and wearing heavier clothing, the heat emission from the human body is very much reduced.

It is naturally difficult to determine the relative bearing of foulness and of overheating, each depending so much on the degree and also on humidity, but the fact remains that overheating has been shown to be injurious in itself and is apt to be more so when combined with foul air, humidity and with pollution through unsanitary heating apparatus. Equable, moderate temperature is, therefore, one of the primary hygienic requirements.

The logical way of meeting it is effective heat control, not only to suit the weather, but to take care of the heat from occupancy. With steam heat, which does not lend itself readily to central regulation, automatic devices for individual rooms are necessary in rooms occupied by a number of persons who are not expected to pay attention to the heating service. In other cases some form of graduated hand control of local radiation may be suf-

ficient. Sometimes fair service can be obtained by the use of long distance devices, facilitating better control of a plant by the engineer from a central point. With hot water heating, automatic regulation is desirable, mainly in rooms that will be crowded on occasion. On the whole, it is easiest with that system to maintain equable conditions. Still better results could be obtained by using gas for fuel in house heating boilers, as is done for bath heaters. The additional operating expense is no longer prohibitive in view of the saving in labor and other advantages. This combination of gas with hot-water heat should be the ideal domestic plant of the future. In this connection it is well to remember that the best heat regulation is often set at naught by some extraneous heat source, such as a hot flue, or a warm floor. All such cases should be looked out for in planning and taken care of.

COOL AIR IS MORE WHOLESOME TO BREATHE

Aside from the desirability of avoiding excess of heat, there is still another lesson in Fluegge's findings. It is well known that a considerable portion of the heat emitted by a human body is contained in the exhaled air. Cooler air inhaled means increased emission owing to additional heat necessary to raise it to the temperature of the body. If the air is cool and sweet besides, it will be inhaled more freely and stimulate functions. Hot and dusty air makes more labor in breathing, gives less oxygen, if only for the same volume, and keeps circulation below the normal. It follows that the lowest air temperature compatible with comfort is the most rational. We all know that the indoor temperature at which one may feel comfortable varies considerably, according to the temper of the occupants, with the relative humidity and other conditions. But our sense of comfort is probably affected quite as much by the temperature of the surrounding objects, as they radiate heat or absorb it from the body. Thus we need less clothing on a sunny day than in cloudy weather, with equal air temperatures. This is so, because radiant heat will pass through the air and to its destination, without appreciably raising its temperature. Incidentally, it will be understood, that air is not spoilt by the heat rays, but by convection, or contact alone. For these reasons a room is apt to be most comfortable if the bulk of its walls is thoroughly warmed by continuous heating service, but the air be kept relatively cool by occasional opening of windows or by a constant inflow of sweet, uncontaminated air not heated beyond room temperature. This idea of warming the walls, or the structure, rather than the air within, is conducive to equable conditions, and reduces the tendency to overheating, by the heat sources, as well as by the air supply, as each can be regulated effectively, and will not interfere with the other. Warmer room air, on the other hand, produces a lower percentage of relative humidity, and naturally tends more to excessive dryness and dust pollution by heating.

For the same reasons it appears to be more advantageous to utilize the radiant heat of direct surfaces, rather than the heat emitted by convection. This would favor the selection of low, widely spaced, flat radiation, which is generally also more sanitary.

COOL AIR AND RADIANT HEAT VS. HOT AIR

The theory of warm walls and cool air also points towards the ideal for the solution of all heating and ventilating problems, that is, to reproduce for indoor life those atmospheric conditions which we know to be most pleasant and wholesome. A direct system with continuous service, with moderately warm, well distributed, clean surfaces giving more heat by a mild radiation than by convection, combined with a tempered air supply in some sanitary form, will certainly be the nearest approach to the mild radiant

heat of the sun and cool bracing air. Any apparatus using fresh air as a heat carrier will produce the opposite effect, resembling more the enervating sirocco, or warm, cloudy weather. In any event, such apparatus necessarily gives warmer air and cooler walls since it is the air that must heat the walls. Besides, the higher the incoming air must be heated, the more it will lose of its natural sweetness. Hot air heating also tends to produce strata of warmer air overhead and cooler air near the floor, a condition which is undesirable from the hygienic as well as the economical point of view. Again, the problem of controlling the heat without either disturbing the air supply or causing other discomforts is decidedly more complex.

There are instances, of course, where heating by air may be indicated, or permissible. The indirect method, however, should be resorted to only in such cases where the heat requirement is relatively small, so that the air supply need not be warmed to an undesirable degree which will spoil it for purposes of ventilation. The same amount of heat may, of course, be obtained with smaller volumes at higher temperature as with larger volumes at lower temperatures, but the best authorities agree that it should not be brought into a room at more than 110° F. Rietschel puts it at 104° F. This is a severe limitation for conditions maintaining here. About 120° F. would seem justified. In cases where it would still result in excessive volumes it is nearly always advisable and proper to reduce the heat requirement by extra protection.

The indirect system is often installed with the idea of securing better ventilation than is expected by direct heat alone. As a matter of fact, the air renewal in either case depends largely on the natural outward leakage afforded by the structure and the draught power of any vent flues available. The inward leakage in one case comes through the register, in the other case through walls and windows. The latter air is apt to be sweeter and purer than that from the stacks. Moreover, the window ventilation can be increased without stopping the heat supply from radiators while the draught in a hot air flue is liable to be reversed under wind action when heat is most needed. The idea of better ventilation through hot air heating is, therefore, nearly always a delusion.

On the whole, the use of the indirect method should be discouraged, especially where a constant air supply of given volume is not essential. In cases where direct radiation is absolutely objected to, there are other means of meeting the situation, for those who have command of the subject. Unfortunately, it would lead beyond the scope of this article to go into the various possibilities.

Direct-indirect heating, with the air inlets back of radiators, is also adversely affected by wind and weather, giving less air when most is needed. Proper control of temperature becomes almost impossible without shutting the inlets, which is the usual fate of these devices. A more satisfactory solution in some cases may be found in the use of very small sash ventilators, admitting fresh air directly, in as many places as possible, deflecting and diffusing it, and thus keeping the room air sweeter and cooler, with comfort depending on the radiant heat provided.

In general, radiant heat is best applied by hot water radiation, which has an average temperature of only 130° to 140° F., and is rarely unpleasant. With steam heaters, the radiation is usually too intense and too concentrated, and should be modified by greater division of surface.

HYGIENE IN VENTILATING

One cannot discuss hygiene in heating without touching on the same principles as applied to modern ventilating apparatus. Even though each should act independently, one may spoil the result of the other,

hence they must be treated in harmony. The first point to be borne in mind when designing ventilating apparatus, more especially an air supply system, is again salubrity. This must not only be made possible, or probable, but compulsory or automatic, inasmuch as the air passages are necessarily out of sight and therefore only too apt to be neglected. In order to prevent dead spaces, which form eddies in the current and create dust pockets, smooth clean metal or tile ducts should lead directly from outdoors to the tempering surfaces and fans, and from the same to the flues and registers. All passages should be of sizes to assure a fair velocity of the air current that will not allow any accumulation of dust and foreign matter at any point, from intake to room. Tempering surfaces should also be spaced for a fair speed, and should be of the kind that will present a smooth surface, completely swept by the air current. The entire system in fact should be designed with the idea of sweeping itself, or making it "clean as a whistle." This is recommended not only with the idea of avoiding all possible contamination but also in order to preserve the natural sweetness of the air, which is always destroyed in contact with organic dust stirred up by the unavoidable motion. Moderate temperature of the stacks for warming, higher speed in passing the surfaces, and lowest practicable temperature of the air supply will always tend to preserve its ozone and oxygen, that is, its life and wholesomeness.

These leading ideas should be carried out just the same, if the air is filtered, washed, humidified and ozonized. Cleanliness cannot hurt the treatment, but will often help it. In fact, all means should first be exhausted to secure fair results by salubrity. Artificial "air conditioning," as it is called, should be reserved for meeting severe conditions or unusual requirements, that is, when it is desired to improve upon the outer air for special reasons. This refers especially to moistening, which is rarely needed, if the air supply is pure and cool.

Ozone should not be regarded as a substitute for ventilation, as it does not supply all the elements required. It should be used only to help in relieving extreme, intense vitiation that would call for excessive air volumes.

Preventive medicine should be used in ventilating work not only in applying hygiene, since poor engineering may offset the effort at sanitation. It is only necessary to point out that there are frequent chances for pollution of room air from outside sources not under control, which may spoil the results, unless taken care of. Lack of provision, for instance, for effective removal of odors from kitchens, toilets, wardrobes, in other parts of the same building almost inevitably make themselves felt. It would lead too far to go into all these probabilities, but in general it is necessary to realize that highest efficiency depends on good engineering as well as on sanitation.

CAPACITY IS NOT THE ONLY REQUIREMENT

The mere capacity of an apparatus to heat, and to effect a certain renewal of air, should no longer be the only criterion of performance. The sanitary requirements must receive equal consideration, if the best results are to be obtained. It will be conceded that the average practice in the planning and installation of apparatus is still deficient in these respects. Indeed, probably the best chances for improvement in this field at the present time may be found in the application of hygiene. In any event, due attention to this subject is more likely than anything else to prevent such extremes as the establishment of open-air schools. It will also tend to overcome the frequent opposition to modern ways of heating and to artificial ventilation on the part of the medical profession, which has no doubt its basis of justification. As a general conclu-

sion it may be stated that the preventive sanitary measures advocated can only increase the efficiency and usefulness of modern installations.

Dust in City Air

By Dr. George A. Soper

Speaking recently before the Boston Society of Civil Engineers, Dr. George A. Soper, who is president of the Metropolitan Sewerage Commission of New York, gave some timely and important acts regarding his observations of the condition of the air, especially in the subways of New York. Dr. Soper makes the broad statement that he never found any dust in the city of New York that did not have iron in it. The principal features of his address are given herewith:

Closely associated with the bacteria in the causation of diseases are the solid particles which air contains in the form of dust. A committee to which I happen to belong was appointed by the American Public Health Association to draw up standard methods for the analysis of air, and reported that the physical properties of the atmosphere are of more consequence to health than the chemical or bacteriological constituents, meaning thereby to place emphasis upon the importance of temperature and humidity, and especially upon the presence of dust, which contaminated air often contains.

Dust is directly or indirectly the greatest enemy of man. Aside from the enormous cost involved in the continuous warfare which is waged against it for the sake of mere cleanness, dust is dangerous to breathe. It is dangerous to breathe, not so much on account of the microbes which it contains, as because it is dust. Physiologists assert that nothing so predisposes the delicate structures of the nose, throat and lungs to invasion by microbes of respiratory diseases and we can all bear testimony to the irritating and aggravating effect which a dust-laden atmosphere produces upon sore throats and colds which most of us experience every winter.

It is probably the very commonness of the dust evil which makes us so indifferent to it, as we must frankly confess ourselves to be. We forget that it is composed of the offscourings of our bodies and the wear and tear of our clothing, habitations, shops, factories and streets, not to mention the comminuted refuse of our kitchens and the dessicated excrement of horses upon the public highways.

We are too indifferent to the way in which it floats in and out of our houses and contaminates the food we eat, the water we drink and the air we breathe.

GRINDERS' ROT

Sanitarians have given much attention to dust, and have divided it into several classes according to its harmful effects upon the human organism. In the dusty trades, so called, the most destructive dusts are those whose composition is most unlike the soft and yielding structure of the respiratory apparatus. The grinding and polishing of metals, and the cutting of hard stone, are, because of their dust, among the most hazardous occupations in which a person can engage.

"Grinders' rot" is a name popularly employed for the tuberculosis which commonly affects knife grinders before middle age. Pneumokoniosis is a longer and more scientific term by which the medical profession designates diseases of the lungs brought on by dust of whatever kind.

There are many dusty occupations, each with a startling mortality peculiar to itself. Upon investigation, the immediate cause of death is always found to be the same—tuberculosis and pneumonia. The

direct cause of death is disease contracted from germs thrown off perhaps by a fellow workman; the indirect cause is a pair of lungs which have lost their normal resilience and peculiar spongy texture and have taken on a hard consistency and dull, somber hue from the dust which they have absorbed. The lungs of coal miners are black, the lungs of men and women who have lived for some years in cities are gray, and the lungs of country people are a bright, healthy red.

Such being some of the conditions of contaminated air, let us glance for a moment at their remedy. We have found that the contamination of air, whether chemical, microbic or particulate, is due to its employment in some way for the use and convenience of man. Air becomes polluted just as water becomes polluted. In each case a fundamental requirement of sanitary science is ignored. From its controlling importance and universal application we may term this requirement the cardinal law of sanitation. This law demands that waste products shall be carried promptly from their source, kept always within control and be inoffensively disposed of.

It is more difficult to observe this law in dealing with air than with water, and in no branch of sanitation will it be found possible to obey it perfectly. It is, nevertheless, our duty to keep its provisions prominently in mind, for no substantial success can be accomplished otherwise.

If the waste products of our furnaces and our factories were to be kept under control until they were utilized or otherwise destroyed, consider for a moment the immense saving in money and human life which would result. If persons sick with the lesser respiratory diseases, not to mention consumptives, were to isolate themselves as much as practicable, or, at least, refrain from visiting crowded assemblages, consider the enormous saving in life and health which would follow. If the filthy dust of our streets were to be kept from our lungs by efficient methods of street cleaning, consider the progress in decency and order, not to mention health, which this reform would accomplish.

PRODUCTION OF DUST ON THE INCREASE

The conservation of health has no better field for effective operation than systematic warfare against dust. With one notable exception, the use of oil on thoroughfares and railroads, no new method of combating this evil has been developed by sanitary science in recent years, while the quantities of dust produced and the harm which it has done have enormously increased with the growth of our cities. As matters stand, the greatest dust scavenger is the atmosphere. Into it we cast the dust of our houses with the same heedlessness with which we dump our sewage into the water courses. We do not stop to think that this air must serve to ventilate our dwellings and shops, and the lungs of our children and ourselves.

IRON RUST

I found that there was produced in the New York subway one ton of dust for every mile every month from the brake shoes alone. At about the same time I estimated there was produced about a ton a mile a month on the elevated roads of New York. I did not take into account the wear on the rails or on the wheels. But so great was the wear on the rails in the subway that the Interboro Company had a special steel made for the rails. They got tired of renewing them.

(*To Be Continued*)

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OUR ATTENTION has been called to a singular omission in some of the published copies of the Pennsylvania compulsory ventilation law. This law, after reciting the general conditions that shall obtain in school buildings costing more than $4,000, specifies that such "school-houses shall have in each classroom at least 15 sq. ft. of floor space and not less than 200 cu. ft. of air space per pupil and shall provide for an approved system of *indirect* heating and ventilation, by means of which each classroom shall be supplied with fresh air at the rate of not less than 30 cu. ft. per minute for each pupil and warmed to maintain an average temperature of 70° F. during the coldest weather."

The omission referred to is the word "indirect," which, as will be readily seen, makes a very decided difference in the type of heating apparatus permissible for such buildings. Those of our readers who have copies of this law as published by the heating engineers' society, or as contained in the vest-pocket edition of "Ventilation Laws," may make the necessary correction by inserting the word "indirect" at the point indicated.

IN VIEW of the interesting agitation now going the rounds championing the efficacy of up-draft ventilation, as well as recirculating methods, it will be refreshing, we are sure, to our readers to note the views in this issue of an expert who comes very close to the heart of the matter in his discussion of "What is the Matter with Modern Heating Practice?"

The art of ventilation may be making slow progress, but its elements, at least, are pretty well established. The present agitation is strongly reminiscent of the earliest days of the art when most of the schemes now proposed were subjected to exhaustive tests, the results of which are of permanent record. It is rather by fixing attention on such phases of the subject as are discussed in the article referred to that real progress is to be attained.

IN a discussion on "The Location of Direct Radiators," by Frederick Dye before the (British) Institution of Heating and Ventilating Engineers and appearing in THE HEATING AND VENTILATING MAGAZINE for December, Mr. Dye's name was inadvertently spelled "Nye." Mr. Dye is a well-known author of a number of works on heating and plumbing, including "Plumbing and Sanitation," "Warming Buildings by Hot Water," "Steam Heating," "Hot Water Supply," and "Popular Engineering."

Legal Decisions

Contract Completed by Third Party

In an action for a balance for furnishing and installing a heating plant in a house it appeared that the owner had given the contract to a third person, who defaulted. The plaintiff, who had the contract for the plumbing of the house, was asked to complete the heating plant. The owner insisted that the plaintiff assumed the original contract, including the price. The plaintiff insisted that he only agreed to install the plant, thus completing the contract, but without any agreement as to the price. Upon the trial he elected to recover the reasonable value. There was a sharp conflict in the evidence as to the terms of plaintiff's agreement, but the court found in his favor that there was no agreement as to price, and for the reasonable value of the labor and material. On appeal the court's findings were held to be justified by the evidence.

Chas. Wilkins & Co. vs. Sublette, Minnesota Supreme Court.

Extra Work Not Included in Contract for Installation of Steam Heating Plant

In this case, which was an action for goods sold, it appeared that the plaintiff furnished some patent valves on the risers of a steam heating plant in the defendants' property. As to this there was no dispute. The plaintiff furnished these goods on an order of the defendants' architect, and their reasonable value, according to the proof, was $50. The defendants claimed that while they directed the architect to order the installation of the goods, they thought the work was covered by another contract between them and the plaintiff for the installation of a general steam heating plant.

No provision was made for the installation of the valves in the original contract between the plaintiff and the defendants. Therefore the work, if ordered by the defendants, was extra work unquestionably. The defendants gave evidence tending to show that they had requested their architect to make provision for the valves in the original contract; but as no such provision was actually made, it was held that they could not defeat the right of the plaintiff to recover for work and materials furnished by their order, simply because their architect had omitted to follow out their wishes in the preparation of his plans and specifications for work to be done under the original contract.

Wm. H. Curtin Mfg. Co. vs. Jaeckel, New York Appellate Division, 125 N. Y. Supp. 1010.

Building Contractors' Failure to Install Ventilators Where Not Intentional

The contractor for the erection of a schoolhouse sued on quantum meruit for work and materials furnished therefor. The defense was that the building was to be erected according to plans and specifications and that the contractor had failed to follow them in that he did not install ventilators. It was held that it was a question of fact for the jury whether the omission of the ventilators was intentional and willful. If it was not, the plaintiff was held to be entitled to recover for the labor and material he had furnished, less any deduction that might be made on account of the ventilators. Their absence was not a structural defect and they could be easily supplied after the building was erected. The picture from which the plaintiff first figured the cost of the school building showed no ventilators at all. Although his contract called for them his alleged reliance on the permission of a school trustee to omit them, though unauthorized, would justify the jury in saying that there had been no intentional departure from the specifications.

Smith vs. Russell, New York Appellate Division, 125 N. Y. Supp. 952.

Interpretation of Contract to Install Heating Plant

A contract to install a heating plant, which provides that the contract shall be for "a complete and perfect job, even though every item required to make it such is not specially noted in the drawings or these specifications," and that the contractor "shall furnish all labor, tools and appliances necessary to complete his work according to these specifications, and shall perform his work in a true workmanlike manner in every particular and thus provide the building with a durable and mechanically perfect system," does not require the contractor to improve upon the plans in order to make a mechanically perfect system.

Ruddy vs. McDonald, Illinois Supreme Court.

Two Expositions in California in 1915

California is planning to hold two expositions in 1915. One will be the Panama-California Exposition in San Diego, ostensibly in commemoration of the completion of the Panama Canal but practically as a means of exploiting the resources and opportunities of the Southwest, Mexico, Central and South America. San Diego is the first port of call in United States territory north of

the Panama Canal on the Pacific Coast and it is the nearest point on Pacific tide water for the cities of the middle west and the southern states.

John C. Olmsted, senior member of the Boston firm of architects, is in San Diego, under contract to design the general character of the permanent buildings of the Panama-California Exposition and to advise regarding the landscape features of Balboa Park, which is to be the site of the exposition.

The other exposition is to be held in San Francisco and will be known as the Panama-Pacific International Exposition. The present plan is to use the water front and Telegraph and Rincon Hills for the exposition, on which it is proposed to spend $17,500,000. Many of the buildings, if the water front site is selected, will be of a permanent character. The interesting feature of the present plans is that the exposition as proposed suggests a miniature map of the entire Panama Canal.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

CENTRAL STATIONS.—Central Station at Newcastle, Ind. Osborn Monnett. Illustrated description of the mechanical equipment of a small central power and heating station. 1200 w. Power—Nov, 8, 1910. 20c.

ELECTRIC POWER SUPPLY ON THE NORTH-EAST COAST.—Illustrates and describes stations utilizing waste heat and gas. 2800 w. Ir & Coal Trds Rev—Nov. 4, 1910. Serial. 1st part. 40c.

DUST COLLECTING.—The Extraction and Collection of Dust in Manufacturing Operations. Describes the Cyclone Reform wet system, and Simon dust collectors. 2100 w. Engr. Oct. 28, 1910. 40c.

FRICTION LOSSES IN PIPES.—Frictonal Losses in Small Air Pipes. Elmo G. Harris. Gives experimental data upon the use of compressed air in small pipes, and coefficients of friction recommended for practice. 1100 w. Min Sc—Nov. 19, 1910. 20c.

HEATING GOVERNMENT BUILDINGS, WASHINGTON.—United States Capitol and Congressional Buildings. Describes the heating, lghting and power plant for the Government Buildings at Washington. 2300 w. El Rev & W Electn—Nov. 26, 1910. 20c.

The Heating of Factory Buildings. Oscar E. Perrigo. Shows the advantages of the positive heated air system and describes a typical installation. 3600 w. Ir. Tr Rev—Nov. 10, 1910. 20c.

MECHANICAL PLANTS.—Mechanical Features of the Blackstone Hotel. Illustrates and descrbes the heating, ventilation and air cooling of this new hotel in Chicago. 3500 w. Met Work—Nov. 12, 1910. 20c.

The Power Plant and Heating System of the Soldan School. The Soldan High School, St. Louis, is a 3-story and basement structure, accommodating 1,600 pupils. Illustrated description of the mechanical equpment for heating, ventilating, lighting, and supplying power for manual training and other uses. 1200 w. Eng Rec—Nov. 12, 1910. 20c.

Power Plant of McCormick Building. Osborn Monnett. Illustrated description of the mechanical equipment of this 20-story building in Chicago. 1800 w. Power—Nov. 1, 1910. 20c.

SHOP HEATING.—The Heating of Factory Buildings. Oscar E. Perrigo. Explains the advantages of the positive heated air system, describin~ a typical installation. Ills. 3000 w. Ir Trd Rev—Nov. 10, 1910. 20c.

STEAM PIPING.—Design and Erection of Steam Piping. Francis H. Davies. States the fundamental principles to be followed in properly laying out a piping system and discusses materials to be used to conform to good practice. 4400 w. Power—Nov. 15, 1910. 20c.

Power Plant Piping. Charles L. Hubbard. Deals with the subject of exhaust piping. 3000 w. Steam—Nov. 1910. 20c.

VENTILATING FAN.—Starting a Ventilating Fan Automatically. S. A. Worcester. Describes starting device operated by clock. 800 w. Eng & Min Tl—Nov. 5, 1910. 20c.

Isolated Plant Protective Association

As the result of a circular invitation signed by Percival Robert Moses, consulting engineer; Charles G. Armstrong, consulting engineer; John Buxton, of the Blue Room Engineering Society; S. F. Ferguson, of Mackenzie, Quarrier and Ferguson; and Charles S. Pearse, of the National Association of Steam Engineers, a meeting was called for January 16 in the Engineering Societies' Building, New York, with a view of forming an isolated plant protective association to promote publicity in favor of isolated plants, and thus counteract the publicity of the Edison and other central station companies. It is also proposed to undertake, through the new association, a movement against discriminatory rates throughout the country and also to watch legislation affecting isolated plants and promote legislation favorable to the installation of isolated plants.

William Henry Bryan

1859-1910

William H. Bryan, whose death in Chicago December 5, was noted in our last issue, was 51 years old. He was born at Washington, Mo., and was graduated from Washington University in 1881. Meantime he had learned telegraphy during his vacation periods in the shops of the Missouri Pacific Railroad. In 1889 Mr. Bryan became secretary and local manager of the Heisler Electric Light Co., at St. Louis, engaged in developing a long-distance line of incandescent lighting. Since 1892 he has been engaged in the consulting mechanical and electrical engineering business in St. Louis. Among his more important designs is the power plants of the Imperial Light, Heat & Power Co. Mr. Bryan was instrumental in securing practical smoke abatement in St. Louis in 1892 and 1893 for the Citizens' Association of St. Louis.

Mr. Bryan was an ex-president of the Engineers' Club, of St. Louis, and was a member of the present Smoke Abatement Committee of the Civic League of St. Louis. He was also a member of the American Society of Mechanical Engineers and of the American Society of Heating and Ventilating Engineers.

His appointment as chief engineer to the Chicago Board of Education was the result of a competitive civil service examination in which Mr. Bryan secured the highest percentage of the large number who took the examination. His appointment was dated Nov. 28, 1910.

In society work, one of Mr. Bryan's most notable achievements was the inauguration of a movement to identify power plant piping and valves by colors. A paper on this subject which he read before a meeting of the American Society of Mechanical Engineers was published in THE HEATING AND VENTILATING MAGAZINE for April, 1908.

At the present time the mechanical engineers' society has a committee on the identification of power house piping and at the recent annual meeting advised the appointing of a special committee on the subject to establish at the earliest possible date a standard system of coloring. The committee itself was also reappointed.

Mr. Bryan is survived by a widow and two children.

Hand-book for Heating and Ventilating Engineers

Since heating and ventilating work of buildings has become an important factor in engineering, there has arisen a demand for a hand-book which would cover the entire field and contain such tables as are commonly used in everyday practice and could be handy without searching through various text-books or current literature. Such a book has been admirably compiled by Prof. James D. Hoffman of Purdue University, Lafayette, Ind.

The book covers, in addition to steam and hot water heating, a careful and thorough study of furnace heating design—a subject which has been very little treated in text-books. The author furnishes an example of a complete design of a small house of two floors and basement plans with method of estimating ducts and sizes of registers.

The author has brought the matter of vacuum heating up-to-date, surveying the latest improved systems and devices—another subject, information on which can be found only in trade catalogues. District heating from central stations is treated in a thorough manner, including formulæ and tables for calculating the sizes of pipe and conduits.

In a similar manner are covered modern devices for temperature control. A chapter is devoted to a suggested course of instruction of heating and ventilation.

A novel feature in the make-up of the handbook is that all the useful tables are gathered together in an appendix, so that one can easily find the data wanted.

To make the book especially useful for reference, the author has given a list of references to books and current technical periodicals for continued reading at the end of each topic.

In general, we consider the book will be found just as useful for the beginner as for the engineer with considerable experience. Size, 4½ x 7 in. Pp. 322. Price, $3.50. Published by the author.

A. M. F.

Creditors Form Company to Complete Contract.

A unique case of the creditors of a failing builder stepping in and forming a company to complete the contract is reported in connection with the Pathological and Male Dormitory Building at Bellevue Hospital, New York. The success of the undertaking which resulted in the completion and acceptance of the building by the city authorities, is due in large measure to the activities of Mr. Frank A. Williams, of the heating and ventilating contracting firm of Blake & Williams, of New York.

The building in question is a $700,000 structure designed by McKim, Mead & White. The general contract for its construction was given to Thos. Cockrill & Sons. The builder failed when the building was about one-half completed and a number of creditors at once secured liens on the material already installed. At this juncture, Mr. Williams, in company with several of the other sub-contractors, organized the Bellevue

Completion Company with Francis A. Williams, president; Allston Sargent, of the Jewett Refrigerating Co., vice-president; James Elgar, of James Elgar & Co., carpenters and builders, treasurer; and Charles J. Hardy, attorney.

Through their efforts all of the liens on the building were withdrawn on the stipulation that the various creditors whose work had to be completed were to receive at least 25% of the value of the apparatus installed and work already done on the building, with payment in full for the remainder of the work as completed.

This plan was successfully carried out and the building was completed and accepted by the city December 1 last, when the final payment was made. The Completion Company collected in all about $230,000 from the city and lived up to its agreement to the letter with the other creditors, besides turning over to the receiver a handsome sum which will be added to the assets of the estate of Thos. Cockrill & Son.

The work of the Completion Company was especially appreciated by the Bellevue Hospital authorities, who were in urgent need of the facilities provided in the new building. As it stands to-day the Pathological Building is equipped with many special fixtures, etc., designed for a variety of purposes. The designing engineers of the steam heating and mechanical equipment were Nygren, Tenney & Ohmes, New York.

Heating and Ventilating System for the Oliver Building, Pittsburg

The Henry W. Oliver Building, Pittsburg, is said to be the largest and highest office building between New York and Chicago. It is 25 stories (347 feet) high above the sidewalk, and has a basement and sub-basement. The sub-basement contains the mechanical plant, work rooms, etc. The basement is divided up for use in connection with the various store rooms which occupy the first floor. Above the first floor the building is devoted entirely to offices.

Power and heat are supplied from the Oliver central power plant, which is connected to this building by a large well lighted tunnel under the street. This tunnel also connects with some 25 other buildings which are supplied from the same plant.

The heating and ventilating plant is unusually complete. The sub-basement and basement are each heated by a seperate hot blast system. The first floor is heated by hot blast and by direct radiation combined. Above the first floor direct radiation alone is used.

The three hot blast systems mentioned above supply a total of 69,590 cu. ft. of air per minute. The heating surface is made up of Vento cast iron radiation.

Between the tempering coil and fan in each case is placed a Webster air washer, built by Warren Webster & Co., Camden, N. J. By means of these air washers two sheets of water are produced in the form of a combined "rain and spray," through which all the air passes, thus removing all dust, dirt and odors. The entrained water in the air is removed by means of the horizontal baffle plates, while the spray water falls into a tank in the bottom of the air washer and, after being strained, is recirculated by means of a centrifugal pump direct connected to an electric motor.

In addition to the cleaning effect of these air washers, the intimate contact

THE OLIVER BUILDING, PITTSBURG, PA.

of the air and water results in raising the humidity of the air. In summer the use of these air washers materially reduces the temperature of the entering air.

Steam for the Vento blast heaters and for the direct radiation is circulated by means of the Webster vacuum system. A 16-in. main from the Oliver central power plant supplies all the steam for this building. Exhaust steam is used at approximately atmospheric pressure. On entering the building the 16-in. steam main divides into three branches, one supplying the blast heaters, a second supplying the radiation on the first floor and a third supplying all the radiation above the first floor. From three

branch mains the various heating units are supplied by risers and branches. The return end of each unit of radiation has a Webster water seal motor, allowing free passage to the return pipe for the air and water of condensation, but preventing the passage of steam. At all points where it is necessary to drain the steam mains a connection is made from the bottom of the steam main into the return main through a Webster dirt strainer and a water seal motor. By preventing the passage of steam into the return main the water seal motor prevents the short circuiting of the steam either through the drip points or through the radiators nearest the supply. It also permits a working vacuum to be maintained without placing an undue load on the vacuum pump.

The system of return piping is all connected into two return mains of 3-in. and 8-in. respectively, which lead to the vacuum pump. The vacuum pump is 18-in. x 16-in. in size, and is driven by a 15 h. p. direct current electric motor. Each of the two return mains above referred to is equipped with a full size Webster suction strainer, where it connects to the suction of the pump. These strainers prevent any dirt or grit from entering the pump chambers and injuring the pump. To prevent interruptions of the heat due to repairs, there are two vacuum pumps, each of sufficient capacity to handle the condensation from the entire system. Each of these pumps is completely equipped and the two are properly valved and cross-connected so that either may run at will. A vacuum of 12-in. of mercury at the pump suction is found to be ample to give circulation throughout the entire system, and this vacuum is easily maintained by the pump.

The vacuum pump discharges the water and air from the system through a 6-in. line into an air separating tank located in the Oliver power building. This tank also receives the vacuum pump discharges from the 25 other buildings heated by the Webster system from this plant. The air is allowed to escape through a vent in the top of the tank and the water goes to the feed water heater and then back into the boilers.

It may be interesting to note the following total figures in connection with this heating and ventilating system:

There are 1,634 direct radiators having a total of 71,479 sq. ft. of heating surface and weighing 488,450 lbs. (about 244 tons).

VIEW IN FAN ROOM, OLIVER BUILDING, PITTSBURG, PA., SHOWING INSTALLATION OF WEBSTER AIR WASHER

There are 140,943 lin. ft. (about 27 miles) of pipe of all sizes, having a total weight of 220,884 lbs. (about 110 tons).

85 tons of galvanized iron were used for ducts in the ventilating system, by which 69,590 cu. ft. of air are supplied to the building and 68,150 cu. ft. are exhausted every minute.

Operation of the Power Plant of the Wells Power Co., Milwaukee

The Wells Power Co., of Milwaukee, Wis., supplies customers in the heart of the business section of that city with electric current and exhaust steam for heating. The original plant was built in the basement of a business block for the purpose of supplying light, heat and power to a syndicate of several surrounding property owners, each to bear a portion of the cost of operating the plant. Later on this idea was developed further and the present company formed to make a business of selling current and exhaust steam throughout the business centre.

The original plant was soon outgrown and it was decided to add to the company's equipment by building a second plant on lines similar to the first. Accordingly the Stevenson Building, distant a few blocks from the original Wells Building, was planned with a basement power station to be operated in parallel with the old plant. The new station was built from designs furnished by the engineering firm of D. C. & Wm. B. Jackson, of Chicago and Boston, and its construction was superintended by this firm.

The new building is situated at the carner of Mason and Milwaukee streets and covers an area approximately 140 ft. square. The entire basement is occupied by the power plant and the remainder of the building is devoted to offices and stores. At present there are installed three 508 H. P. water tube boilers supplying steam to two cross-compound non-condensing vertical engines at 150 lbs. pressure. These machines each drive a 500 K. W. D. C. generator producing current at 250 volts. The usual three-wire balanced direct current system of distribution is employed, furnishing current at 240 volts for motors and 120 volts for incandescent lighting.

The main units exhaust into a heating main during the winter months and in summer to the atmosphere. All the heating systems connected onto the power company's mains are operated with a vaccum on the returns so that the back pressure on the engines rarely rises above 2½ lbs. As these engines were designed especially for these conditions, the economy at anywhere near full load is remarkably good, the horsepower being developed on approximately 20 lbs. of steam.

In order to prevent the possibility of high back-pressure on the engines and also in order to keep the load factor up, the company has adopted a policy of accepting no heating contracts without the accompanying lighting contract, although lighting will be supplied without heating. The result is that the heating and lighting loads are extremely well balanced, there being plenty of exhaust steam to supply heating except at very rare intervals when live steam from the boilers is used.

In the summer time when, of course, the heating load practically disappears the engines are still run non-condensing. This is because of the difficulty of obtaining sufficient condensing water without undue expense, due to the fact that the power plant is at a considerable elevation. Both boilers and generators stand a very considerable overload without any trouble and, due to the use of underfeed stokers, the smoke production is very light—a very valuable feature in a plant situated in as closely built up a section as is the case with this station.

A Large Pumping Contract

One of the largest contracts for pumping machinery ever placed has just been awarded to the Alberger Pump Company, New York, by the Bureau of Yards and Docks, the total sum involved being slightly over $323,000.

The contract covers pumping equipment for the three new dry docks to be constructed by the Government at New York, Puget Sound and Pearl Harbor Navy Yards. and includes, all told, eleven 54 in. vertical volute pumps, each direct-connected to a 500 H. P. induction motor, and seven 15 in. vertical volute draining pumps, each direct connected to an 85 H. P. induction motor; also all necessary suction and discharge piping, electrically-operated gate valves for the same and all electrical controlling apparatus for the motors. Three of the 54 in. units will be located at New York, while four of these units are required for each of the other docks.

Each unit is required to operate against a static head, varying from zero, when the dock is full, to a maximum of 42 to 44 ft. when the dock is completely empty, while operating at a constant speed of 219 R. P. M. without exceeding the rated horse power of the motor at any point. In addition to this, each pump is required to maintain an average capacity of 66,000 gals. per min. when emptying the dock from approximately mean high water to 1 ft. above the elevation of the keel blocks, the static head varying from zero to 32 or 34 ft. Under these conditions the contractor has guaranteed an average efficiency of 45% for New York and Pearl Harbor and 46%

for Puget Sound, these efficiencies being the ratio of the actual useful work in pumping the docks to the electrical input to the motors, and, consequently, includes all losses in the motors, pumps and piping. To meet these average efficiencies it is necessary for the pumps themselves to reach a maximum efficiency of nearly 80%.

In addition to obtaining a high efficiency, the other characteristics of the pump have to be very carefully determined in order to meet the special conditions involved in this class of work.

Revised List of Nominations

The ballot containing the nominations of officers in The American Society of Heating and Ventilating Engineers, as finally revised, is as follows:

FOR PRESIDENT

Reginald Pelham Bolton, New York.
B. F. Stangland, New York.

FOR FIRST VICE-PRESIDENT

John R. Allen, Ann Arbor, Mich.
S. R. Lewis, Chicago.

FOR SECOND VICE-PRESIDENT

A. B. Franklin, Boston.
R. B. Collamore, Detroit.

FOR SECRETARY

William M. Mackay, New York.
Charles E. Scott, New York.

FOR TREASURER

U. G. Scollay, Brooklyn, N. Y.
Thomas Barwick, New York.

FOR BOARD OF GOVERNORS

(Five to be elected.)

J. D. Hoffman, Lafayette, Ind.
Howard T. Gates, New York.
Aug. Kehm, Chicago.
J. A. Goodrich, Lansdale, Pa.
Henry S. Downe, London, Eng.
R. C. Carpenter, Ithaca, N. Y.
Jas. H. Davis, Chicago.
Charles G. Armstrong, New York.
L. B. Sherman, New York.
John T. Bradley, St. Louis, Mo.

American Institute of Chemical Engineers

At the annual meeting of the American Institute of Chemical Engineers, held in New York December 7-10, 1910, the following officers were elected: President, Dr. F. W. Frerichs, St. Louis, Mo.; vice-presidents, George P. Adamson, Easton, Pa.; Eugene Haanel, Ottawa, Ont.; Dr. Leo H. Baekeland, Yonkers, N. Y.; secretary, Prof. J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.; treasurer, Henry S. Renaud, New York; auditor, Herbert Hollick, Camden, N. J.

American Society of Mechanical Engineers

Officers elected at the recent 31st annual meeting of The American Society of Mechanical Engineers in New York December 6-9, were as follows: President, E. D. Meier, St. Louis, Mo.; vice-presidents, George M. Brill, Chicago; E. M. Herr, Pittsburg; H. H. Vaughan, Montreal, Can.; managers, D. F. Crawford, Pittsburg; E. B. Katte, New York; and Stanley G. Flagg, Jr.

As the election of Mr. Meier to the presidency left a vacancy in the list of vice-presidents, the matter was taken up at a later meeting of the council and Dr. Alex. C. Humphreys was elected vice-president.

The attendance at the various sessions was 633 members and 410 guests.

American Society of Engineer Draftsmen

The American Society of Engineer Draftsmen, which was founded in New York, June 18, 1910, has lately issued an interesting handbook containing, in addition to its constitution and officers, a general idea of the scope of the society and reasons why draftsmen should become members of it. It is proposed, not only to hold regular meetings at which professional papers will be read, but also to maintain an engineering library, an employment bureau for the exclusive benefit of members and the collection and distribution of all obtainable data relative to the conditions governing employment in the various drafting rooms throughout the world, as well as statistics on other subjects of interest to its members.

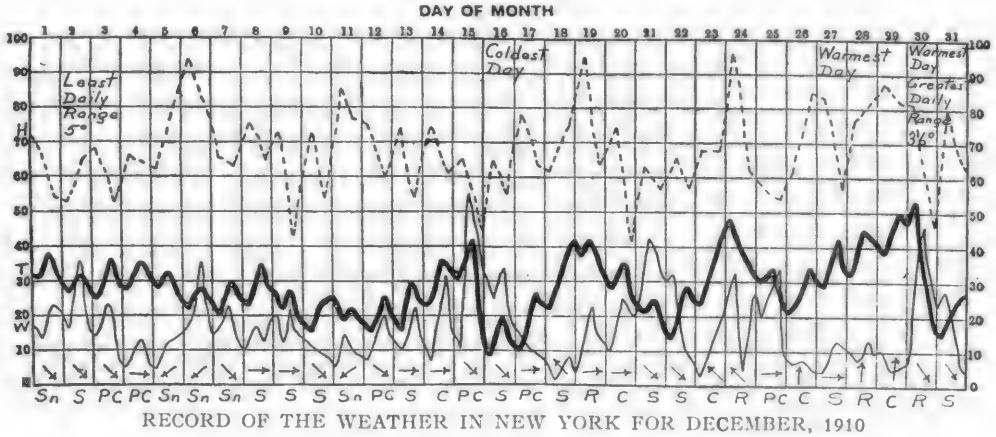
Membership in the society is extended to engineers, professors of engineering, designers, inventors, draftsmen and detailers. A junior grade of membership includes students of engineering or drafting, tracers and mechanics. Provision is made for the organization of local chapters. Dues are fixed at $3.50 per year, with an initiation fee of the same amount. The dues will be raised to $5 after 1,000 members have enrolled.

The headquarters of the society are at 116 Nassau street, New York, and the present officers are: President, E. Farrington Chandler; vice-president, William B. Harsel; secretary-treasurer, Henry L. Sloan.

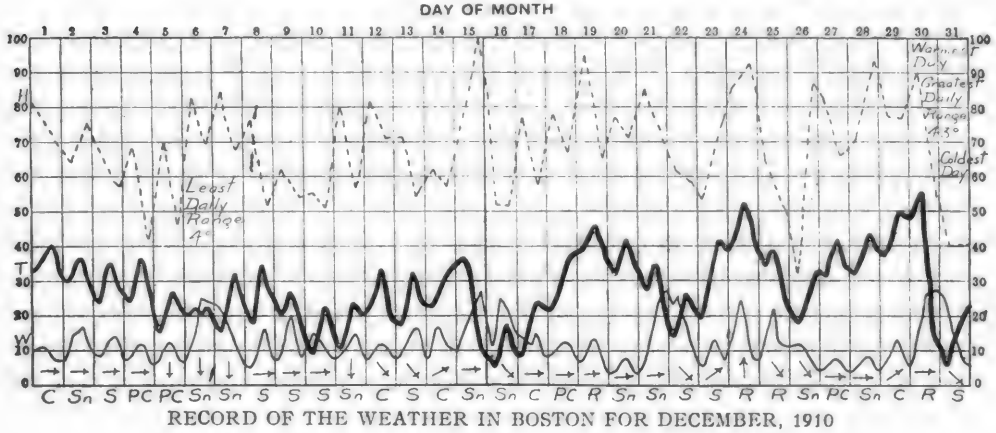
Collin Valve Co., Portland, Me., capital $100,000, to manufacture valves for water, steam, gas, etc. President, William A. Cullenan; treasurer, Harold Swett.

The Weather for December, 1910

	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, degrees F.	53	55	55	43	54
Date of highest temperature	30	30	29	27	17
Lowest temperature, degrees F.	9	6	11	7	11
Date of lowest temperature	16	31	16	12	24
Greatest daily range, degrees F.	36	43	25	20	27
Date of greatest daily range	30	30	18	11	14
Least daily range, degrees F.	5	4	4	3	6
Date of least daily range	2	6	12	5	22
Mean temperature for month, degrees F.	28	28	27	26	32
Normal mean temp. for this month, dg. F	34.4	31	33.8	29.3	36
Total rainfall, inches	1.95	2.1	2.87	1.32	1.18
Total snowfall, inches	8.9	8.1	13	9.2	2.2
Normal precipitation, this month, inches	3.45	3.32	2.78	2.07	2.17
Total wind movement, miles	10555	8636	8994	10888	8617
Average hourly wind velocity, miles	14.2	11.6	12.1	14.6	11.6
Prevailing direction of wind	West	N. W.	N. W.	West	N. W.
Number of clear days	12	10	4	8	14
Number of partly cloudy days	8	6	7	8	3
Number of cloudy days	11	15	20	15	14
Number of days on which rain fell	5	4	6	3	5
Number of days on which snow fell	10	11	22	19	5
Snow on ground at end of month, inches	None	None	1.5	0.8	None


DAY OF MONTH
Least Daily Range 5°
Coldest Day
Warmest Day
Greatest Daily Range 31½°
Sn S PC PC Sn Sn Sn S S S Sn PC S C PC S Pc S R C S S C R PC C S R C R S

RECORD OF THE WEATHER IN NEW YORK FOR DECEMBER, 1910


DAY OF MONTH
Least Daily Range 1°
Warmest Day
Greatest Daily Range 43°
Coldest Day
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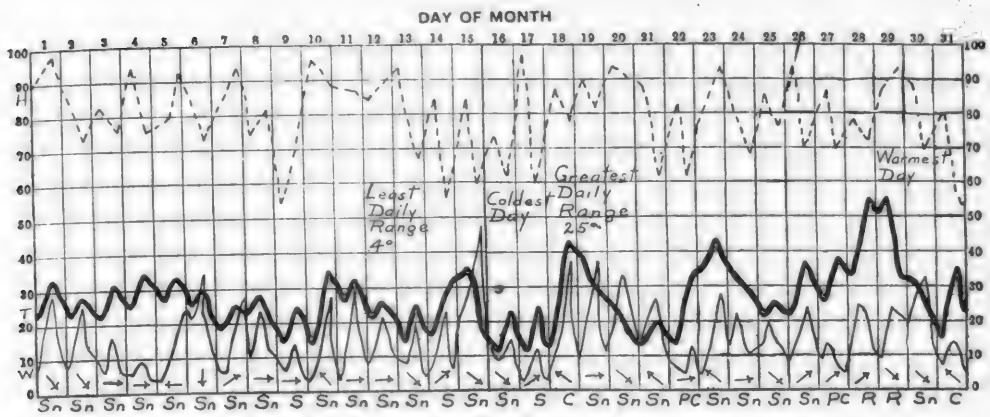
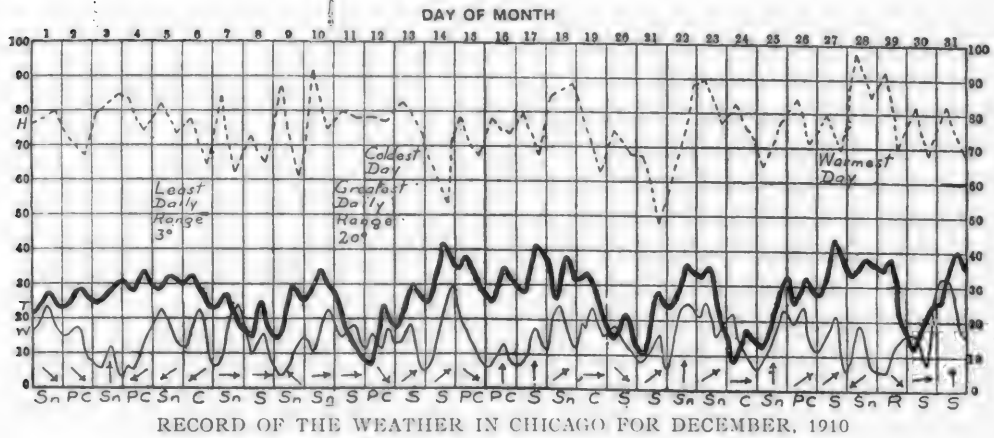
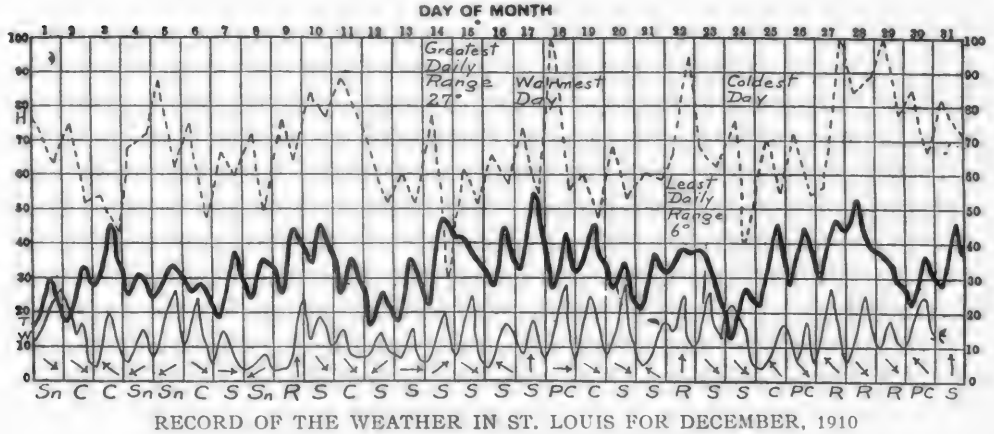
RECORD OF THE WEATHER IN BOSTON FOR DECEMBER, 1910



RECORD OF THE WEATHER IN PITTSBURG FOR DECEMBER, 1910



RECORD OF THE WEATHER IN CHICAGO FOR DECEMBER, 1910



RECORD OF THE WEATHER IN ST. LOUIS FOR DECEMBER, 1910

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentagt fromireadings taken at 8 A.M. and 8 P.M.

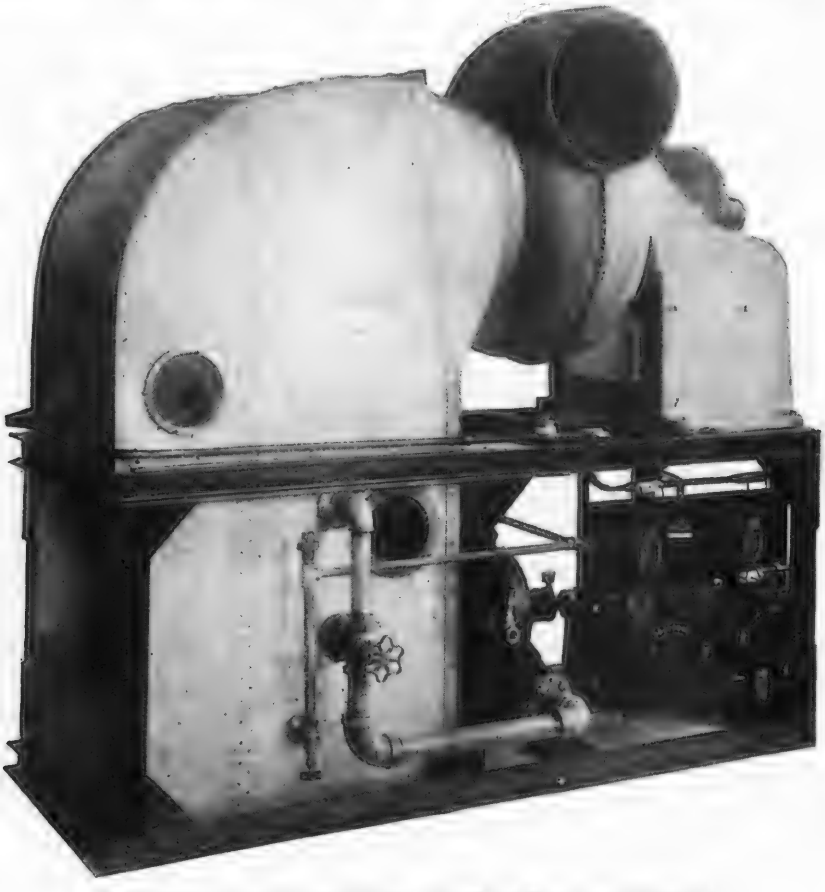
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—Snow.

Arrows fly with prevailing direction of wind.

New Type of Self-Contained Ventilating Equipment

The need of compactness in the construction of heating and ventilating apparatus has become almost imperative in view of the increasing number of devices that now go to make up a complete installation. An important step in this direction is the self-contained ventilating equipment illustrated herewith. The feature of this unit is the combination of a McCreery air washer and motor driven pump erected on the same base with the blower. It thus requires only air, water and electric connections. By this arrangement the apparatus is able to deliver cooled air in summer, humidified air in winter and purified air all the time. The equipment is rigidly built with plate and angle iron frame and is shipped ready to run. Other noteworthy features in its construction are that all the adjustable parts are easily accessible, iron parts touched by moisture are galvanized, while the unit itself is compactly designed to fit closet or waste space. No calculations of air velocities are necessary. The blower, it will be noted, is under speed control for intermittent ventilation and, in addition, air is always purified, whether recirculated or drawn from the outside.

This equipment, which is made by the McCreery Engineering Co., Detroit, Mich., is built in seven sizes delivering from 2,000 to 7,000 cu. ft. of air per minute.



McCREERY SELF-CONTAINED VENTILATING EQUIPMENT

Atmospheric System of Steam Heating

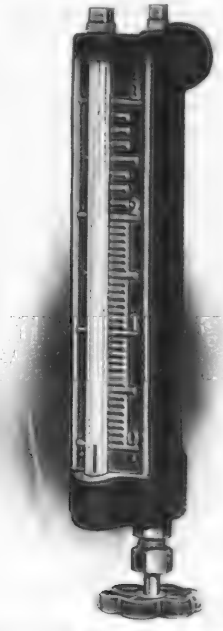
The importance of regulating the temperature of radiators, especially in steam heating, is now recognized as one of the most important features of an up-to-date heating system. Among the successful methods of doing this and one that has won wide approval is the Atmospheric System, designed and sold by the American District Steam Co., Lockport, N. Y. This system of steam heating is based on the principle of supplying the steam to the radiator at practically atmospheric pressure in the form of vapor as a means of heat distribution. The term "atmospheric" is used to distinguish this method of heating from that of forced pressure, or vacuum systems. The supply

may be from the ordinary steam boiler, through underground mains conveying steam from a central plant, or utilizing exhaust steam. Where the supply is from a central plant, the pressure is usually reduced as it enters the building, by means of a pressure reducing valve, to

ADSCO GRADUATED RADIATOR VALVE

approximately 5 oz., and it is supplied at this pressure throughout the building. In individual boiler installations the pressure is controlled by a combined damper regulator and relief valve.

Steam is supplied to the radiator at the top through a specially constructed valve, known as the Adsco graduated radiator valve. This valve is so graduated that it is possible to supply steam to any desired portion of the radiator, up to approximately 85% of its total surface,



MERCURY GAUGE FOR USE WITH ATMOSPHERIC SYSTEM

depending upon the amount of heat required. The remaining portion of the radiator is used as hot water radiation. The water of condensation passes from the radiator into the return piping through an ordinary union elbow.

The return pipes, containing no steam, do not require covering, but are grouped into a main return and connected into an open receiver. The water of condensation passes from this receiver to the meter through a water seal and thence to the sewer, or into the underground return line of the district heating system.

If the installation be in connection with an individual boiler, the condensa-

RECEIVER FOR BOILER INSTALLATION, AT MOSPHERIC SYSTEM, GRADUATED IN OUNCES

tion is returned to the boiler through a receiver such as that shown in the illustration.

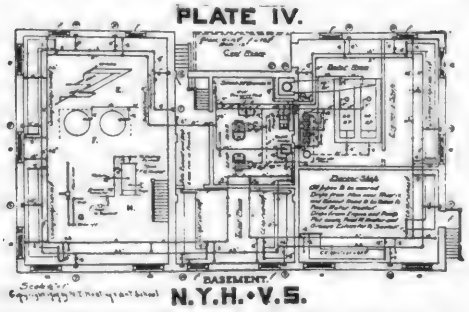
A mercury gauge, as well as a water gauge, has been designed by us for use on "Atmospheric" installations. The ordinary steam gauges are not adapted to this class of service owing to the fact that they cannot be properly graduated into ounces, and, further, for the reason that they are unreliable for the very low pressures carried in "Atmospheric heating."

These gauges are not required on individual boiler installations as the receiver illustrated is graduated in ounces and is all that is required, although if desired the mercury gauge may be installed on any riser.

The graduated receiver is designed for use in connection with boiler installations. It is open to the atmosphere through air pipe "E" to chimney. The water of condensation and air from the radiators and piping passes into the receiver from returns at points "DDD," and from the receiver the condensation is returned to the boiler by gravity. It is graduated into ounces, each ounce representing an equal pressure on boiler. No steam gauge, therefore, is necessary.

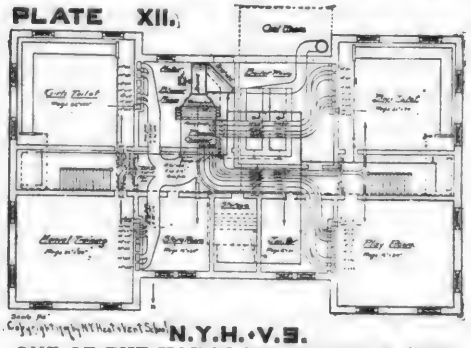
A Remarkable Fund of Heating and Ventilating Data

Comments on the course of instruction on heating and ventilation, which was placed on the market some time ago by the New York Heating and Ventilation

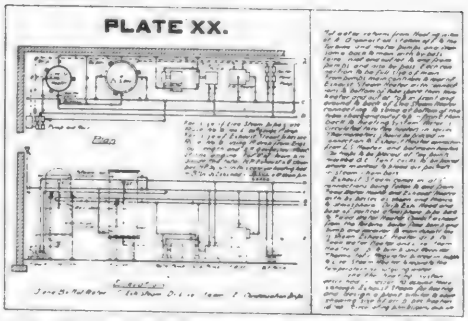


ONE OF THE PLATES IN THE LESSON ON EXHAUST STEAM HEATING

School, 1123 Broadway, New York, indicate that the fund of information it contains constitutes an important contribution to the knowledge of the art. The school reports a large and growing number of students, with but one withdrawal since the school was established over a year and a half ago. The data on forced hot water heating, as well as the instruction on hot blast heating, is proving especially attractive to the students and many expressions have been received de-

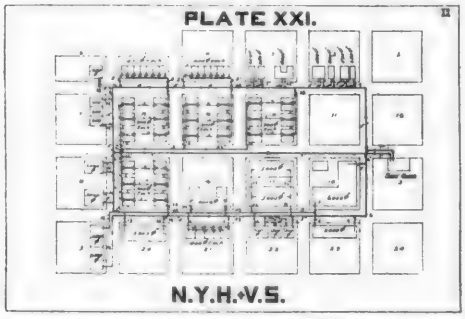


ONE OF THE HOT BLAST LESSON PLATES



ONE OF THE FORCED HOT WATER HEATING PLATES

claring that the hot water heating instruction alone is worth the cost of tuition. The school comprises many well-known heating and ventilating engineers, as well as draftsmen and heating contractors. The opinion of an experienced engineer on the course is interesting as he states that "we are none of us too old to learn and I am free to admit that many of your formulas and short-cut



ONE OF THE PLATES IN THE CENTRAL STATION HEATING LESSON

methods are new to me and fill more than one breach in my stock of knowledge. Where you are going to win out is in your method of teaching. You go to the heart of the matter at once in each lesson and any one who has any knowledge of the business at all has a wonderful opportunity of perfecting his knowledge through your system of instruction."

Another engineer, after looking over the lesson sheets, stated: "I consider that these sheets contain the most valuable data that has ever been put into print on this subject. Certainly, I have never seen anything like it and I am familiar with all the text books and instruction courses that have appeared. Any student who successfully finishes your course should have no difficulty in laying out any job he is called upon to handle."

The school publishes an interesting circular describing its methods, list of lessons, etc., which, we understand, will be sent to those asking for it.

National Volume Blowers and Exhausters

A cast-iron volume blower and exhauster that is adjustable to either right or left hand, or any desired discharge, is an interesting apparatus, manufactured by the National Blower Works, Milwaukee, Wis. The general appearance of these fans is very pleasing, and

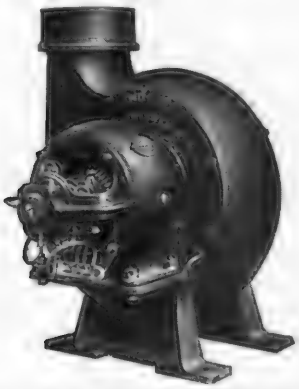


FIG. 1.—DIRECT-CONNECTED MOTOR-DRIVEN NATIONAL VOLUME FAN

the workmanship of the best. Bearings are of the ring-oiling type, babbitted and bored. The shaft is of turned steel and of ample proportions. The wheel, in the smaller sizes, has cast steel spiders; in the larger sizes the spiders have tee iron arms, cast into cast-iron hubs, and of the same general construction as the wheel used in their planing mill ex-

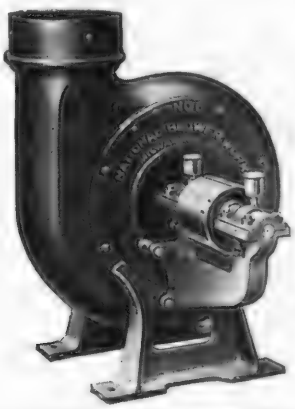


FIG. 2.—DIRECT-CONNECTED PULLEY-DRIVEN NATIONAL VOLUME FAN

hausters. Special wheels are also furnished. These may be of either sheet steel or cast iron, to suit any particular requirement. Figs. 1 and 2 show direct-connected motor driven and pulley driven fans. We are advised that further information in relation to these fans will be gladly furnished by the manufacturers.

Trade Literature

Wainwright Water Heaters and Expansion Joints, made by Alberger Condenser Co., New York, are the subject of a new catalogue in which these devices are not only fully described and illustrated but their principles of operation are gone into at length. The catalogue contains many suggestions to the designing engineer, such as sketches showing various ways of making the pipe connections to Wainwright feed water heaters. The reading matter throughout is written on an engineering plane that cannot fail to win appreciation from those interested in this type of apparatus. In addition to the devices mentioned in its title, the catalogue also treats of Wainwright automatic controls, Wainwright heat extractors, for compressed air, oil, gas, steam or water, Wainwright anchors and guides, various types of Alberger condensers, cooling towers and turbine pumps.

Economical Fire Room Methods, by F. R. Low, is the title of Bulletin 187, Sturtevant Engineering Series, December, 1910, published by the B. F. Sturtevant Co., Hyde Park, Mass. The matter contained in the bulletin is a reprint appearing in "Power" and contains a description of the 100,000 H. P. power plant in the wood mill of the American Woolen Co. at Lawrence, Mass. In this plant the return tubular boilers are hand-fired at regular intervals with uniform quantities of coal. Sturtevant fans furnish the draft and a Sturtevant economizer reduces the temperature of the escaping gases to 200° F. and raises the temperature of the hot-well water from 105° to 185° F. A view is shown of the Sturtevant economizer as installed consisting of 792 9-ft. pipes in 72 sections of 11 pipes each, a total of 1,584 pipes to each section of the plant. The total heating surface of the economizer is 78,656 sq. ft. The fans used are of the three-quarter housed steel plate type, 16 ft. high by 5 ft. 4 in. wide. There is also reproduced a series of figures giving evaporative tests showing results seldom equalled regularly in any boiler plant. The bulletin is handsomely printed and may be had, we understand, upon request.

Ilg Portable Ventilating Sets are shown in a new illustrated circular published by the Ilg Electric Ventilating Co., Chicago and New York. These sets are designed for easy removal from place to place and are especially useful for ventilating club rooms, toilets, smoking rooms, sick rooms, vaults, kitchens, photographic dark rooms and telephone booths. The device consists of an encased fan, the fan wheel being direct-connected to a motor shaft. A galvanized iron discharge pipe comes with the apparatus, made so that it can be readily

fitted into a window panel. The makers also furnish, when desired, a flexible canvas discharge hose. The apparatus is made for both direct and alternating current and comes in two sizes, one size having a capacity of 95 to 135 cu. ft. of air per min. and the other from 160 to 320 cu. ft. of air.

CORRESPONDENCE

Takes Issue With Dr. Evans

Editor HEATING AND VENTILATING MAGAZINE.

I am compelled to take issue with the views of Dr. Evans in the article in your December issue in that, with a plenum system such as he describes, there will be a dead air zone at or near the breathing line. The writer has never found any such condition in any case where sufficient air was introduced for ventilation provided the air was admitted at a higher temperature than the normal temperature of the room. Under these conditions stagnant air is practically impossible.

Wind conditions and air leakage will sometimes cause an unbalanced and erratic distribution, but positively will not produce a stagnant zone such as described. Absolutely even heating and ventilating have been and are being secured constantly where the leakage is controlled or tight windows provided. Even heating and ventilating is an impossibility where direct-indirect radiation is used. This has been conclusively proven to those familiar with the relations of air currents in connection with heating and ventilating.

The statement that only by opening the windows and periodically "blowing" out the rooms can the bacteria content be lessened or removed is certainly a queer statement and, if true, mechanical ventilation is a farce.

How any man who seems to have such a wholesome dread of bacteria as the doctor can recommend such a prolific breeding place as a water pan on a direct radiator is beyond me and the average intake of a direct-indirect radiator is not exactly the most cleanly place to be found. Does it not seem inconsistent that the dust is to be allowed to unrestrictedly enter through these channels and through open windows while we are to shroud the blackboard erasers to get rid of some of the dust here created?

The system of heating and ventilating proposed is not new; it has been discarded long since for safer and saner methods and by no means should replace the plenum system now generally in use, such as described in the article in question. It can possibly be improved upon and will probably be from time to time, as experience dictates. Such articles as the one in question from such a high source show more conclusively than ever the need for a campaign of education in matters pertaining to ventilation, and it behooves those of us who are making an effort to get better ventilation to combat any such theories and prove their fallacy in their inception.

F. K. DAVIS.

Baltimore, Md., January, 1911.

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TRADE AND MISCELLANEOUS NOTES

Coming Events

American Society of Inspectors of Plumbing and Sanitary Engineers, Milwaukee, Wis., Feb. 6-8, 1911.

National Association of Master Plumbers, Galveston, Texas, June, 1911. Headquarters at the Hotel Galvez.

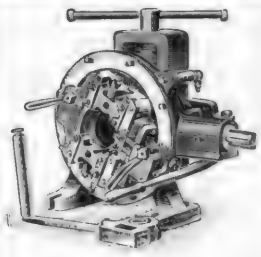
Deaths

Matthew Kennedy, treasurer of the Kennedy Valve Mfg. Co., Elmira, N. Y., died Nov. 26, at his home in that city.

R. Barnard Talcott, heating and ventilating engineer in the office of the Chief Mechanical and Electrical Engineer of the Treasury Department, Washington, D. C., died in Lutherville, Md., Dec. 4. He was 78 years old and was a member of the American Society of Heating and Ventilating Engineers.

Ira Budd, a well-known heating and plumbing contractor of Newark, N. J., died Dec. 14 at his home in Newark after a prolonged illness. He was 59 years old and had been connected with the plumbing and heating trade throughout his business career. He was prominent in trade association circles, having been successively secretary, vice-president and for three years president of the Newark Master Plumbers' Association. He was also the first president of the New Jersey State Master Plumbers' Association and served for many years as state vice-president for New Jersey of the plumbers' national association.

Edward G. Herendeen, formerly president of the Herendeen Mfg. Co., Geneva, N. Y., which was merged some time ago with the United States Radiator Corporation, died at Pinehurst, N. C., from heart failure December 20. He was 52 years old. Mr. Herendeen, at the time of his death, was senior partner in the law firm of Herendeen & Mandeville, Elmira, N. Y.



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ARMSTRONG No. 00 PIPE MACHINE

CUTS OFF AND THREADS PIPE

From 1 Inch to 4 Inches

TO BE USED FOR EITHER HAND OR POWER

Manufactured by

THE ARMSTRONG MFG. CO.

321 KNOWLTON STREET

BRIDGEPORT, CONN.

NEW YORK CHICAGO

ROBERT A. KEASBEY CO.

Heat and Cold Insulating Materials.

85% Magnesia and Asbestos Air Cell

Pipe and Boiler Coverings

CORK COVERINGS FOR BRINE PIPES, Etc.

100 North Moore Street
NEW YORK CITY

Telephone 6097 Franklin

ESTIMATES FURNISHED AND CONTRACTS EXECUTED

Manufacturers' Notes

New York Radiator Co., Frankfort, N. Y., has increased its capital stock to $100,000.

E. F. Reece Co., manufacturer of taps and dies, and F. E. Wells & Son, manufacturers of pipe threading tools and machinery, both of Greenfield, Mass., have merged their interests. The new firm will occupy the quarters of the Wells company which will be enlarged.

H. Mueller Mfg. Co., Decatur, Ill., has increased the capacity of its plant by the addition of a two-story building, 50 x 100 ft. The building will contain two new 200 H. P. boilers and a new 600 H. P. engine. This equipment gives the company's plant a total horsepower of about 1,200.

O'Reilly & Blatt, Reading, Pa., successors to the Prizer-Painter Stove & Heater Co., announce that they are prepared to furnish castings for the line of stoves and hot air furnaces formerly made by the Prizer-Painter Co., also for the Henderson Thermo boilers.

H. B. Smith Co., Westfield, Mass., is adding several new buildings to its South Side plant, including a machine shop, 100 ft. x 100 ft. and two stories high; a 100 x 245 ft. foundry building, connecting with the present foundry; a steel frame building to replace the present wooden storehouse; and a concrete core building 80 x 100 ft. and two stories high.

John Simmons Co., New York, the well-known heating and plumbing supply house, has arranged an extensive display of plumbing goods at its new plumbing goods show room, 48 East 41st street, in charge of C. W. Frean. The warehousing facilities of the Bush Terminals in Brooklyn are utilized, direct communication to them being had through the telautograph system.

Michigan Pipe Company, Bay City, Mich., reports a recent instance of its steam pipe casings having successfully withstood a wear of 30 years. In one instance of a special test a line of wood casings were taken up after a use of 10 years and the covering found to be in perfect condition. The company states that wood casing with the tin lining and air space between the wrought iron pipe and inner surface of the wood is used by the largest central heating plants in the country and is claimed to be the best prevention of condensation and heat loss on the market.

B. F. Sturtevant Co., Hyde Park, Mass., reports, among its recent orders, the ventilating apparatus for the Ritz-Carlton Hotel, New York; forced draft

Richard Warren Chapman

Continuous Jointless Pipe Covering
Asbestos and Magnesia Products

Radiator Shields
Fans and Coils
Air Washers

Monadnock Block
CHICAGO

equipment for the New York Central power house, New York; apparatus for the South Orange (N. J.) school and the apparatus for the Manual Training High School in Newark, N. J.

Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., reports the following recent installations of its boilers in New York and vicinity:

Home of the Daughters of Jacob.
Beth El Sisterhood.
Nichthauser & Levey, Brooklyn.
Brunswick Realty Co., 118 East 28th St.
Pollard & Steinam (sanitarium).
Brody, Adler & Koch, 8-10 West 19th St.
Club House, at 48-50 Henry St.
Schaeffer & Carroll (synagogue).
Apartment Const. Co., 810 Broadway.
Pollard & Steinam, 394 Fifth Ave.
Whiteney Steen Co. (Golden-Hill Bldg.).
Master Builders Assn., 8-14 East 12th St.
Edgar Lehman (residence West 79th St. and Riverside Drive).
Pollard & Steinam Apt. Hotel, 12th St. and Fifth Ave.
Maas & Blum, 124th St. and First Ave.
R. M. Silverman Realty Co., 17-19 West 17th St.
F. C. Zobel, 32-34 West 20th St.
Fischel Realty Co., 48-50 West 21st St.
Brody, Adler & Koch, 40-42 East 19th St.
Gobel Residence, Brooklyn.
Harris & Seigel, 121st and Lenox Ave.
Isaac Polstein, West 99th St.
McKinley Realty Co. (McKinley Bldg.).
Goodyear Rubber Co., 64th and Broadway.
Roosevelt Court, 69th St. and Amsterdam Ave.
Lebanon Hospital Training School.
Jones Speedometer Co., 76th St. and Broadway.

Miscellaneous Notes

Midland Club, at its annual meeting, December 13 at the LaSalle Hotel, Chicago, re-elected the following officers for the ensuing year: President, A. W. Williamson; vice-president, L. J. Mueller, Jr.; secretary, Allen W. Williams. A paper was presented by R. L. Spellerberg, Dubuque, Iowa, on the use of large pipes in furnace heating.

Columbus, O.—A plan to heat the new cell blocks at the penitentiary by steam at a cost of $18,000 was adopted by the board of penitentiary managers, early in December.

Baltimore, Md.—The property and assets of the Baltimore Refrigerating and Heating Co., which have been in litigation for several years, will be sold at public auction under the decision of Judge Stockbridge in Circuit Court No. 2. The Continental Trust Co., holder of a mortgage on the property, has been named as trustee to make the sale. The purchaser will be required to deposit $25,000 when the property is sold. The property is said to be worth nearly $2,000,000 and has been in the hands of the receivers for more than two years.

Philadelphia, Pa.—The first account of the estate of William Sellers, formerly president of the William Sellers Co., tool and machinery manufacturers, who died in 1905, was filed by the executors December 8 and shows the estate to include property valued at $5,622,238.18.

Detroit, Mich.—Indictments against 16 firms and 32 individuals alleged to have secured control of over 85% of the annual output of enameled iron bath-tubs, sinks, lavatories, etc., in the United States, which were returned by the Federal grand jury December 6, are against the following firms:

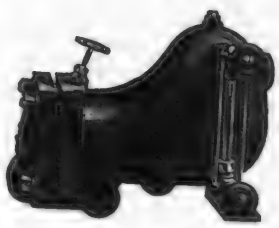
SPARE YOUR TOOLS

By using Dixon's Pipe-Joint Compound on joints. No damage to tools or fittings then when you want to open joints.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J.

McDaniel Improved Steam Trap

WILL DO THE WORK



When you need a Steam Trap buy one you know will work. With a McDANIEL we take all the chances. Don't pay until you are satisfied. We have been 25 years manufacturing Steam Traps and know there is no better trap made. May we send you one for trial?

Watson & McDaniel Co.

160 North 7th Street - PHILADELPHIA, PA.

Send for Catalogue

Standard Sanitary Mfg. Co., Pittsburg, Pa.; L. Wolff Mfg. Co., Chicago, Ill.; A. Weiskittel & Sons Co., Baltimore, Md.; The Barnes Mfg. Co., Mansfield, O.; The Cahill Iron Works, Chattanooga, Tenn.; Colwell Lead Co., New York City; The Day-Ward Co., Warren, O.; The Humphryes Mfg. Co., Mansfield, O.; Kerner Mfg. Co., Pittsburg, Pa.; The J. L. Mott Iron Works, New York City; McVay & Walker, Braddock, Pa.; The McCrum-Howell Co., New York City; National Sanitary Mfg. Co., Salem, O.; Union Sanitary Mfg. Co., Noblesville, Ind.; Wheeling Enameled Iron Co., Wheeling, W. Va.; United States Sanitary Mfg. Co., Pittsburg, Pa.

In addition to the charge of combining to restrain trade by refusing to sell to jobbers handling the goods of so-called independents, the indictments mention the practice of fixing resale prices and the combination's refusal to sell to jobbers not maintaining such resale prices.

Chicago, Ill.—The annual meeting of the Supreme Fold of the United Bunch of Sheep of America, which was announced to have been held December 17, was postponed until the first Friday in March.

Montpelier, Vt.—A committee of the House of Representatives has been named to investigate the $35,000 ventilating system recently installed in the Capitol, which is not proving satisfactory.

National Association of Brass Manufacturers, at its annual meeting in New York, December 13-14, elected the following officers for the ensuing year:

President, Theodore Ahrens, Louisville, Ky.; trustees: A. S. Hills, Haydenville, Mass.; W. H. Wasweyler, Milwaukee, Wis.; C. C. Hale, New Haven, Conn.; D. H. Roberts, Detroit, Mich.; F. Somerville, Toronto, Canada; J. W. Sharpe, Jr., Philadelphia, Pa. The next meeting will be held in Chicago in March, 1911. Wm. M. Webster, 109 Randolph street, Chicago, was reappointed commissioner.

Dresden, Germany.—A congress of heating and ventilating engineers will be held in Dresden, June 11-14, 1911. The meeting will thus coincide with that of the International Hygiene Exposition in Dresden.

Charles G. Armstrong & Son, consulting engineers, Singer Building, New York, is a new firm composed of Charles G. Armstrong, the well-known mechanical and electrical engineer, and his son,

Jenkins Bros. Y or Blow-off Valves

are especially adapted for use where the unobstructed flow of thick fluids is required. As blow-off valves they have no superior. Having a full opening nearly in line with the pipe, but little resistance is offered to the free flow of steam or fluids. Have Jenkins Discs, removable seat rings, and interchangeable parts throughout. Made in Brass or Iron body.

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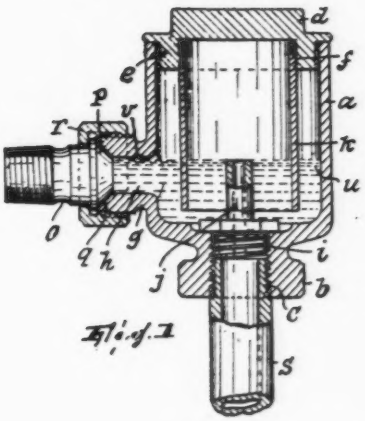

Fig. 1

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Francis J. Armstrong, who is a graduate of the Manual Training School in Chicago and of the Stevens Institute of Technology.

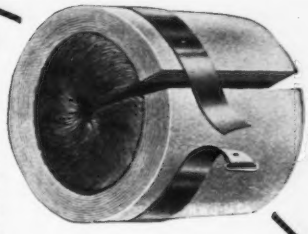
George D. Howell, of the McCrum-Howell Co., New York, has returned from a trip to the Panama Canal and other points in Central America. He was at the canal during the visit of President Taft and, on invitation of Col. Goethals, traveled with the presidential party by rail to Ancon, the Pacific terminus.

O. E. Willis, formerly with the American Heating and Ventilating Co., Philadelphia, has entered the engineering department of E. G. Woolfolk & Co., heating and ventilating engineers and contractors, 151-153 West 31st street, New York.

W. H. James, who has been in the service of the Peck-Williamson Co., Cincinnati, O., for the past ten years, acting as salesman, has resigned. Mr. James will introduce to the manufacturers of heating apparatuses his recently patented down-draft method of burning fuel. The method, it is stated, may be applied to any kind of fuel-burning apparatus.

Cement Age, of New York, and *Concrete Engineering* of Cleveland, two of

Prevents Pipes Freezing



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as you can waiting for pipes to freeze up so you can thaw them out. Pipe covering business is good the year round. You can cover pipes that probably never would freeze. Then you can sell people at a distance, who would call in the nearest plumber if their pipes should freeze.

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the leading monthlies in the cement field, have been consolidated, the change becoming effective with the January, 1911, issue. The two journals are consolidated under the title of "Cement Age with which is combined Concrete Engineering."

Contracts Awarded

E. O. Nay Co., Pasadena, Cal., heating and plumbing new Y. M. C. A. building at that place for $18,000.

Baker, Smith & Co., New York, have been awarded the contract for the installation of the heating and ventilating system in the new post-office building in New York. Their bid was $165,546, time 230 days. Among the other bids received by the Supervising Architect were the following:

G. A. Suter, New York, $185,700; time, November 1, 1912.

Thompson-Starrett Co., New York, $185,770; time, October 15, 1912.

E. Rutzler Co., New York, $182,741; time, November 1, 1912.

Blake & Williams, New York, $189,878; time, 18 months.

Lynch & Woodward, Boston, Mass., $179,770; time, October 1, 1912.

S. Faith & Co., Philadelphia, Pa., $234,920; time as specified.

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Gillis & Geoghegan, New York, $195,600; time, November 1, 1912.

Hoben & Doyle, Philadelphia, Pa., $190,000; time, December 1, 1911.

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Position wanted by a practical heating engineer, contract agent and manager of central steam heating plant, with a first-class company. Seven years' successful experience. Address, Central Station, care of HEATING AND VENTILATING MAGAZINE.

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Heating and Ventilating Buildings, a standard manual for heating engineers and architects. By Prof. R. C. Carpenter. Fifth edition, largely rewritten. 577 pages. 277 Ills., 8vo, cloth. $4.00.

Baldwin on Heating; or Steam Heating for Buildings By William J. Baldwin. Fifteenth edition. Revised and enlarged. 391 pages. 131 figures. Size, 5x7½ in. Contains descriptions of steam heating apparatus for warming and ventilating large buildings and private houses, with remarks and tables. Cloth, $2.50.

Handbook for Heating and Ventilating Engineers. By Prof. James D. Hoffman and Benjamin F. Raber. The latest book on this subject. Unusually comprehensive. 320 pages, with 45-page appendix. Size 4½x6¾ in., bound in flexible leather. Price, $3.50.

Questions and Answers on the Practice and Theory of Steam and Hot-Water Heating. By R. M. Starbuck. Illustrated. $1.00.

The Ventilation of the Schoolroom. By William J. Baldwin. Price, $1.00.

Ventilation of Buildings. By William G. Snow and Thomas Nolan. 83 pages. Pocket size. Contains a statement of the general principles of ventilation and of their application to different kinds of buildings. Boards, 50c.

Steam Heating and Ventilation. By Wm. S. Monroe. Containing formulas and data valuable in the designing of heating and ventilating plants. Price, $2.00.

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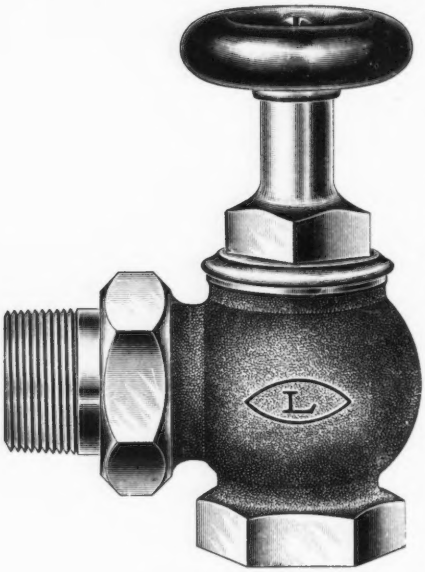

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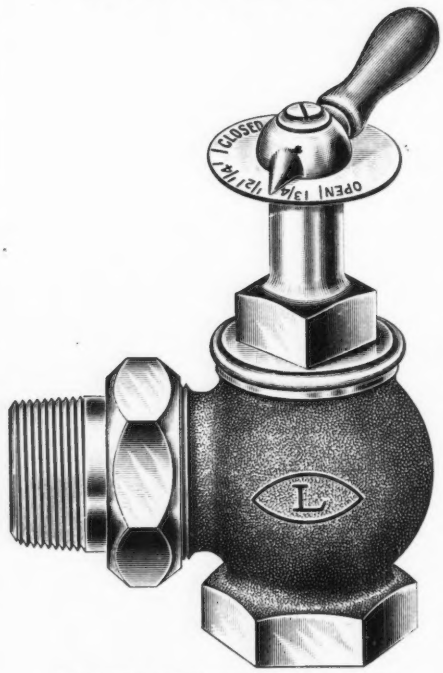

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